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The Academy of Natural Sciences

OF

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FOR THE YEAR ENDING NOVEMBER 30, 1921.

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Special Reports by Members of the Scientific Staff Based on Recent Explorations Conducted in the Interests of the Academy.

MINERAL COLLECTING IN THE ANDES.

(The Vaux-Academy Andean Expedition of 1921)

BY SAMUEL G. GORDON.

It was the writer's privilege to make a trip through the Andes from Ecuador to Chile during the summer and autumn of 1921. The expedition was made primarily to secure mineral specimens for the William S. Vaux Collections in the museum of The Academy of Natural Sciences of Philadelphia, and to obtain material for crystallographic research in the laboratory of the Academy. Incidentally a collection of Andean rocks of much interest was secured. As the scientific results will be published in a series of mineralogical and petrographic papers in the PROCEEDINGS of the Academy, the present account covers merely the itinerary and observations of general interest made during the trip.

The South American Cordilleras, aside from their scenic beauty, present much of interest to the traveller who desires to delve into their scientific aspects. To the geologist, the structural features of the great mountains and the volcanic phenomena manifest in many parts of the Andes, present problems whose study form attractive field; and in no less degree alluring to the mineralogist are the interesting mineral species which have been discovered in the various Andean mines, many of them of unusual composition, or crystal form.

It is of course impossible to present a detailed account of a trip so crowded with incidents and we shall therefore touch only upon such localities, or happenings that are of exceptional interest.

After eight hours passage through the Panama Canal, our vessel the "Huallaga" entered the beautiful bay of Panama, steamed past Taboga Island, and headed southward for that much maligned city, Guayaquil.

Guayaquil lies about sixty miles up the sultry Guayas River. The houses of the city are built of painted plaster on a framework of bamboo, so that the general effect is that of a stage scene, rather than of substantial residences. Beyond the city, the houses are built entirely of bamboo, but supported on stilts.

CHIMBORAZO, ECUADOR

There is a railroad from Guayaquil to Quito, the capital, situated on the plateau in the interior. A small river steamer takes one across the wide Guayas River to Duran. After passing through dense tropical growths, in which plantains are most in evidence, the train begins the ascent to Riobamba, one of the more important towns on the plateau. This part of Ecuador is quite picturesque. The roads are hedged with cactus, and on clear days one may obtain fine views of Chimborazo, Altar, and Tunguragua. The plateau from Riobamba to Quito was called the Avenue of Volcanoes by Whymper from the thirty or more peaks which dominate the landscape. One of the best known is Cotopaxi, considered to be the highest active volcano known with an altitude of 19,600 feet, and now and then adding to it. Others, Iliniza, Corazon, Antisana, and Cayambe on the equator, are no less beautiful.

Quito is situated at the foot of the volcano Pichincha, which possesses several craters. A trip was made to the largest one, only to find it entirely enveloped in fog.

The Peruvian coast, south of Ecuador is extremely arid and consists of reddish and yellowish cliffs backed by low, barren hills. Occasionally a rift in the clouds will reveal a snow-capped peak in the far-off Andes. A few oases occur where small streams, arising in the mountains, descend to the coast. About the only life to be seen are the thousands of sea-birds circling about the numerous guano islands, or an occasional school of seals sporting in the sea.

The coastwise steamers make numerous stops, perhaps to take on a load of cattle or hogs for the Lima market. In many cases cattle are driven a journey of four or five days from the interior, and then loaded on steamers bound for Callao. From the beginning of the drive to their slaughter they receive no food.

By this time our steamer had on board, in addition to the cabin passengers, a quantity of Indians and Cholas, fifty or sixty Chinese immigrants, a great number of cows, pigs, sheep, chickens, and ducks, two goats, a monkey, and a few odd parrakeets.

Five days after leaving Quayaquil the steamer entered the harbor of Callao, the chief seaport of Peru. The boat was immediately surrounded by a number of launches from which swarmed hundreds of fleteros, or porters. Their charge for taking passengers and baggage ashore depends largely on the appearance of the passenger, and his familiarity with their language and rates, so that it soon occurs to one that they must be the direct descendents of Pizarro's piratical band. When the demand for Conquistadores was over, they perhaps entered the fletero business.

Lima is situated but half an hour's ride from Callao. However charming this city may be in summer, it is far from being a pleasant place in the winter season, due to the heavy mist and fog that is always present.

The Central Railroad ascends the Andes to Aroya by means of a great number of tunnels and switchbacks. Branches continue the road to Morococha, Huancayo, Goyallarisquisqua, and Cerro de Pasco. Soon after leaving Lima, the fog and clouds are left below. At Chicla the snow-capped peaks come into view, and rapidly it becomes cold. Ticlio, the summit, 15,665 feet in altitude, was reached late in the afternoon. The rarity of the atmosphere cast a pall over the passengers, with here and there a sign of distress, or perhaps a frown at the crazy gringo who insisted on keeping the window open. At Aroya a change of cars is made for Cerro de Pasco, several hours ride across the plateau.

CUZCO, PERU.

Cerro de Pasco is 14,500 feet in altitude, and the native town apparently glories in the reputation of being the dirtiest town in the world.

This part of Peru contains its richest mines, for here are situated the important copper and silver districts, Cerro de Pasco, Morococha, and Casapalca; and the coal mines of Goyallarisquisqua, Quisquacancha, and Oyon. Aside from their great economic importance, the districts are of interest to the mineralogist because of the superbly crystallized enargite, tetrahedrite, and bournonite, which are frequently found.

A day and a half's ride on the faster steamers is sufficient to take one from Callao to Mollendo in southern Peru. The port is but an open roadstead, and steamers, as usual, anchor far out. From Mollendo it is half a day's ride to Arequipa, and two and a half days to Cuzco.

As one approaches Arequipa, the Pacific is left far below, and the volcano Misti appears above the horizon. The country traversed is extremely monotonous, save for the distant volcanoes and the many symmetrical crescent shaped sand dunes, often beautifully ripple-marked. Arequipa lies at the foot of Misti, and enjoys an almost perfect climate.

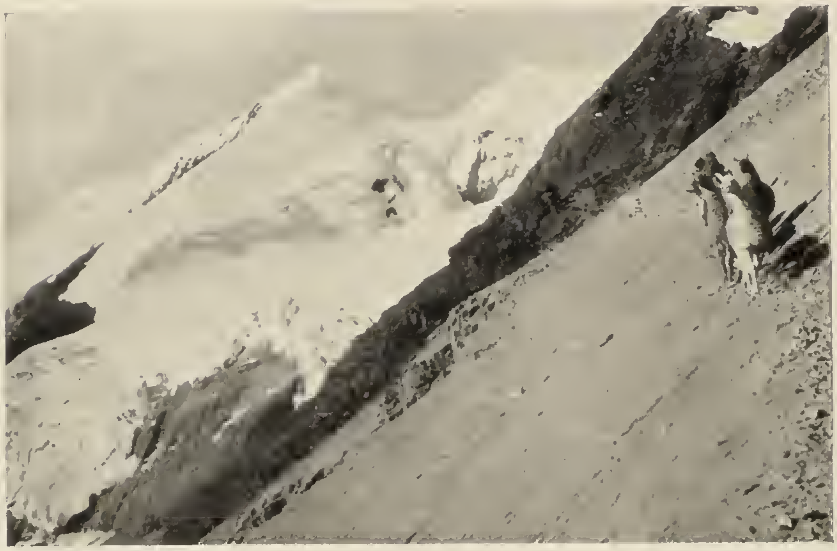
INCA CAVERN, CUZCO, PERU.

The ride to Cuzco is quite uninteresting until Sicuani is reached. The railroad then follows the Vilcanota River, through a rich agricultural valley, where cultivation has been extended by ancient terraces to the steep hillsides above.

Early one evening we arrived at Cuzco, and boarded a small car drawn by a mule.

The ruins in Cuzco consist largely of the walls of the palaces of the Incas, which line many of the streets, and on which have been grafted many later structures. Of particular interest is the Temple of the Sun, the Convent of La Merced, perhaps the most ornate of the Spanish structures, and Ccoleccompata which contains what remains of the palace of Manco Capac, the first Inca,--perhaps one of the finest bits of masonry known.

To the northwest of Cuzco is a steep hill on top of which are the massive fortifications of Sacsaihuaman; and still farther north a small knob, known as the rodadero, of great interest to the geologist as an exceptionally fine example of slickensiding. At this place the rock has been carved into what is now called the Inca's seat. It is not unlikely that much of the overlying rock and soil was removed to expose the grooving so well.



CHOJÑACOTA: THE BOLIVIA OF THE IMAGINATION.

About a mile east of the fortifications is a curiously carved hill of limestone known as the Chinganas. Beneath the hill is a cavern on one side of which is a sort of altar, and opposite it a seat. In the rear is a chimney which lets light down from the surface.

Unfortunately the writer had not time to visit Pisac, Ollantytambo, Machupichu, and the various islands of Lake Titicaca which abound in Inca and pre-Inca ruins.

It is a long day's ride to Puno on Lake Titicaca, a journey across which brings one into Bolivia. At Puno the Peruvians examine all the baggage. This performance is repeated by the Bolivians on the other side of the Lake. Here we meet also the Bolivian consul.

Before leaving Philadelphia the Bolivian consul had vised my passport. This paragon of virtue, however, insisted that the Philadelphia consul's vise was worthless, and therefore charged me four soles for another.

Lake Titicaca is about the size of Lake Erie, and 12,500 feet above the sea. A fine lake steamer, the "Inca," leaves Puno in the evening, and arrives at Guaqui early the next morning. It was a clear moonlight night when we crossed, but so cold that the decks were soon deserted. It is not strange that the Incas were sun-worshipers!

Glaciers of Chojñacota, Bolivia.

At Guaqui connection is made with the train for La Paz, the capital of Bolivia. Soon after leaving the lake, Tiahuanaco, famous for its monolithic pre-Inca ruins, is passed.

After a short ride, the ice-covered range forming the eastern Cordillera may be seen in the distance. La Paz lies in the canyon of the La Paz river, about 1,500 feet below the level of the plateau. To the south is Illimani, one of the highest mountains in South America, about 21,500 feet. The distant walls of the canyon are eroded into peculiar and fantastic forms.

La Paz is quite a modern city, but one of great contrasts, for here one may meet Europeans elbowing Indians on the pavements, while in the narrow streets llamas gaze haughtily at the clanging trolley cars in dispute of the right of way. In the Grand Hotel Paris on the plaza, one may even find running water, which the best hotels in Lima cannot boast of. In these countries the majority of the hotels are named Grand Hotels, much as our local hostelries are called Mansion houses, but in Latin America the names are of even less significance.

Bolivia is essentially a mining country, notably rich in deposits of tin, silver, bismuth, tungsten, and copper. While modern methods are employed in the largest mines, those in the smaller ones are primitive indeed. In the latter type a tunnel is situated far up on a mountain side, reached by a narrow trail. The ore is carefully handpicked by Indian women and sent down on wire cables in buckets made of cow-hide. Within the mines, Indians may be employed to turn the wooden drums with which the ore is hoisted in the winzes. In many cases the mines are situated at altitudes of 12,500 to 16,000 feet, or even 17,000 feet, frequently near picturesque glaciers or ice-covered peaks, about which great condors may frequently be seen to soar.

The principal method of travel in Bolivia beyond the *ferrocarril* is by means of a pack-train and an *arriero* whose chief duty is to keep the mules going in the right direction. This is accomplished chiefly by means of his calloused toe, or by specimens of such rocks as may be close at hand.

Northeast of La Paz is the mining district of Huayna Potosi, so called from a beautiful snow-capped granitic mountain, about which the deposits of tin and bismuth occur.

More important, however, are the Quimsa Cruz and Araca districts lying southeast of Illimani.

Fiestas form the most important part of Bolivian life, and the Bolivian calendar is liberally filled with them. The Indians begin celebrating about a week before the holiday in anticipation of the event, and by that time become so enthused that it is another week before the celebration is over. About that time another fiesta is in sight.

The natives don costumes for the occasion, frequently coats made of ocelot skins. Bands composed essentially of large drums and reed instruments parade continuously about the villages. The music is very monotonous as it runs pretty much to the same tune.

When the writer arrived in Oruro, the celebration was still in progress. Of chief interest seemed to be the bull-fight, and most of the population was gathered at the bull-ring, or thickly scattered on the hill overlooking it. Belts of money are tied on a bull, which is let into the ring. Then, anyone who is desirous of increasing his wealth to the extent of a few centavos, is privileged to help himself. Our sympathies are naturally with the bull, and when occasionally one turns and bowls over an Indian our interest increases, and we admit that it is not such bad sport after all.

Oruro is the mining center of central Bolivia. Some distance to the southeast is the district of Huanuni which is of interest as furnishing the rare germanium-bearing minerals cylindrite and franckeite. Still farther southeast is Llallagua, the world's greatest producer of tin. Adjacent to it are the similar mines of Uncia.

Two days distant by mule are the old silver mines of Colquechaca. The road leads out from Uncia, across a pampa, towards the distant range. On the way, one meets many Indians trudging into Uncia for the Sunday market, some with considerable loads, others idling along, strumming carelessly on musical instruments made from the backs of armadillos.

After a long day's ride you arrive at a tambo. A tambo is a low building of adobe, with a thatched roof, and one or more rooms. On each side of the rooms is a couch of adobe brick. If you are not fortunate enough to carry a bed, the llama skins masquerading as saddle blankets on the mules are thrown on the bricks. Late in the afternoon of the second day Colquechaca appeared in sight, and we were soon clattering down the old cobbled streets. The mines in former days were exceedingly rich in argentite, pyrargyrite and argyrodite.

Potosi is the most celebrated mining district of Bolivia, as it is reputed to have produced over a billion ounces of silver. According to the old Spanish laws, claims or boca-minas could be obtained for the modern equivalent of a few bolivianos per hectare. The holder of a boca-mina was permitted to tunnel in any direction until he ran into a tunnel belonging to someone else. As a consequence, mining on Potosi Mountain is a history of continual warfare between the boca-minas. The visitor finds much of interest also in the great number of ornate old Spanish iglesias. At the colorful native market, the opportunity is presented of seeing types of Indians from various parts of the plateau and the montaña.

In southern Bolivia are the important silver mines of Pulacayo and Chocaya, and the tin, bismuth and tungsten mines of Chorolque and Tasna. The latter produces most of the world's supply of bismuth.

The Andes forming the boundary between Chile and Bolivia and Argentina include a large number of volcanoes. At Ollagüe is a volcano of the same name, alleged to have an altitude of 18,200 feet. It exhibits fumarolic activity. The rock is largely andesite. From the fumarole the vapor rushes with a terrific roar. About the small vents the rocks are coated with beautiful deposits of greenish-yellow and orange-colored sulphur.

A short distance south of Ollagüe is the great borax deposit of Ascotan.

The volcano San Pedro also exhibits some fumarolic activity. At its foot is a small but symmetrical volcano which from the distance looks like a museum-sized specimen. This cone is of recent origin and the erupted material consists largely of olivine basalt.

On the hills northeast of Calama are the extensive copper deposits of Chuquicamata, which are noted among mineralogists for the many rare sulphates produced.

Further southeast is a small town in the desert called Sierra Gorda. Sierra Gorda is a collection of calamena shacks upon which the sun burns ceaselessly. The town appears to be largely deserted, and the few inhabitants remaining seldom venture out into the sandy stretches which form the few streets. In either direction across the desert are some low hills, in which there was formerly considerable mining. The district is of interest as having formerly produced some exceedingly rare sulphates.

Not far from Sierra Gorda one meets the first nitrate oficina, the Oficina Aconcagua, and is well into the Atacama desert. There are but few oases in this great desert whose length is about a thousand miles. Copiapo, the most important one, is situated in the southern part of the desert, and formerly was the center of a very important mining district.

One may sail for days along the coast which contains but a few towns whose existence is due solely to the nitrate industry. Antofogasta is the most important of these. It obtains all its water by a pipe line from some small lakes fed by melting snows of a few volcanoes in the Andes, 250 miles distant.

The whole coast is very unstable, and subject to frequent earthquakes. On several occasions the writer has had to talk on this subject, and on this trip he had hoped to experience a good earthquake so that in the future his remarks would contain a little personal experience on the subject. But unfortunately, the earthquakes were not functioning when he was there, and this was the one regretful part of the trip.

COLLECTING GRASSHOPPERS IN THE SOUTHERN ROCKIES AND THE PLAINS.

By James A. G. Rehn.

As long ago as the year 1905, Mr. Morgan Hebard, now a Research Associate and Councilor of the Academy, and the writer conceived the ambitious project of carrying out a field reconnaissance of the United States, solely with the object of securing material and information for a contemplated monographic study of the Orthoptera of that region. The Orthoptera are the order of insects which embraces the cockroaches, mantids, phasmids or walking-stick insects, short-horned grasshoppers, katy-dids or long-horned grasshoppers, and the crickets. Since 1907 this work has been carried on with considerable regularity and with the most satisfactory results.

To date the field activities have necessitated individual travel of over sixty thousand miles in train and automobile, aside from saddle, pack-train and foot travel. During portions of the years 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1915, 1917, 1919 and 1921, a total of eighteen months has been spent in the field in this study. Financially the support for this work has been almost entirely supplied by Mr. Hebard, and very largely through similar assistance the preparation of the vast collections secured has been made possible.

The material secured to date comprises over ninety-two thousand specimens, all of which will remain in the custody of the Academy, in its own collection and as the depository of the Hebard Collection, until study work has been completed, and duplicate series distributed to other institutions which have assisted by the loan of valuable and important material. Reports have been published in the Academy's PROCEEDINGS upon the collections secured in 1905, 1907, 1908, 1911 and 1913, while special and critical papers on certain groups, utilizing material secured other years, have also been published. A number of extensive papers, preliminary to to the final work, are also in course of preparation or projected.

In addition to the collections made by Hebard and Rehn, others totalling many thousands of specimens from important regions in the United States have been secured from thoroughly responsible collectors, and in this way a representation of close to two hundred thousand pinned and labelled specimens of North American Orthoptera has been made available for study. The detailed and exact examination of such a collection requires years, and it also involves an almost incredible amount of painstaking labor. In consequence tangible scientific results of the work are but slowly becoming evident.

The areas selected for the field work of 1921 were sections of northern New Mexico, the "Panhandle" and Staked Plains region of Texas, Oklahoma and eastern New Mexico, and southwestern Colorado. Much work had been done by us in previous years in Texas, but no locality in the "Panhandle" had been examined, while we wished very greatly to compare the Orthoptera of the Staked Plains with those of the more typical Great Plains to the northward. Northeastern New Mexico was the original locality of certain species described nearly fifty years ago, and these to-day are among the forms concerning which we have but little information. In addition, in the last mentioned region we wished to secure information on the passage from a true desert fauna to a campestrian or plains assemblage. Southwestern Colorado is a region which has had but a limited amount of entomological study. The relative detachment of its high mountains, and the penetration of the region by a pronounced desert element of Painted Desert origin, made its examination hold more than usual interest.

Perhaps to most people grassy plains would be considered ideal localities for grasshoppers, and with very good reason, but many forms, and these in consequence often the least known and most local species, are limited to high mountain meadows, the grassy glades of the Canadian Zone forests and the natural gardens of the Hudsonian Zone, or even the bare rocks of the peaks above the timber line. Others are found only in the shade of deep forests, while vast numbers of species are at home under the blaze of a desert sun. In consequence regions as diverse as below sea-level in Death Valley, and the summit of Mount Whitney at 14,500 feet in the Sierras, the lowest and highest points within the United States, have required examination in our work. In the field season of 1919 a most striking new species of grasshopper was found in the former locality, and an even more remarkable new genus and species of katy-did was secured on the latter summit.

Leaving Philadelphia July 31, 1921, the writer spent the first twenty days of the trip working alone, Mr. Hebard joining him at Amarillo, Texas, on August 20. The first stop was made at Syracuse in the Great Plains region of western Kansas, where a sandhill area south of the Arkansas River was examined. Raton, New Mexico, was the next work center and there a study of conditions on the Raton and Johnson Mesas, as well as the adjacent plains to the south, occupied the time. Remnants of a very old lava sheet, these and similar mesas, or table-topped ranges, project to the east of the Rockies for many miles, forming a decided barrier to north and south travel. Thanks to the erosion-resisting capping of hard volcanic material, which in much of this region overlays one of the most important coal deposits in the Western States, the summits of several of these mesas are very level and plains-like. These areas are splendid pasture land, or in large part cultivated, receiving more rain in summer and snow in winter than the lower plains. The plains to the southeast and south of Raton are dominated by isolated volcanic peaks, such as Mt. Capulin and Eagle Tail Peak, reminders of the days, far more recent than those of the crusting of the Raton Mesa, when these regions were in the throes of volcanic activity.

A brief stop at Wagon Mound, New Mexico, gave an opportunity to study the grasshopper fauna of several volcanic cones nearby, one of these hills from its fancied shape having supplied the early Anglo-Saxon pioneers with the name now applied to the town. In quest of additional information upon certain species which had been secured there in previous field work, several days were spent in the vicinity of Albuquerque, working in the flood-plain of the Rio Grande, on the bench toward the Sandia Mountains, and in an extensive sand area west of the river. A brief side trip to Holbrook.

Arizona, and Gallup, New Mexico, on their respective sides of the New Mexico-Arizona state line and both west of the Continental Divide, was productive of important information from the region of a limited fauna.

At Gallup were secured two specimens of one of the strangest meloid or oil-beetles known from our country. Resembling nothing so much as an inflated bladder about an inch long, barred with cross stripes of black and blood-red, and with wings and wing-covers reduced to a functionless minimum, this unusual beetle was scrambling over the stony hillside. The species is one of the genus *Megetra*, a truly remarkable member of a family of beetles containing many weird and striking forms. One of the katy-dids sought at both Albuquerque and Holbrook is of infrequent occurrence in spiny desert vegetation. The species is flightless and very protectively colored, so the search is a constant and unremitting examination of the clumps of wiry scrub or brittle brush. Ocular examination must be accompanied by "beating," which is an energetic brushing of the shrubbery with a heavy sheeting net supported by a very strong and yet resilient spring steel frame. As this is carried on steadily hour after hour, the reader can appreciate the collector's evening rest is fully earned. In fact, probably two-fifths of all the Orthoptera to be secured in the western United States must be taken in this way, and almost an equal amount by similar "sweeping" of grasses and low annuals. The species taken by individual location and stalking, or in flight, are far fewer than the uninitiated would suppose. There is little of the delicacy of butterfly catching in Orthoptera collecting, instead more of the swing of the reaper with a suggestion of the carpet beater.

The Plains of eastern New Mexico were examined at Vaughn and Tucumcari,—the latter pronounced Twó-cum-carey. Vaughn is quite high for the Plains–6000 feet–and it was not as satisfactory a locality as Tucumcari, which is at less than 5000 feet elevation. At the latter locality a number of species which we were extremely anxious to secure from this general region were taken. Here to the west bench-like mesas break the uniformity of the plains, which are otherwise quite level, unlike at Vaughn, where they are rolling downs.

In order to determine more clearly to what extent the orthopterous fauna of the Staked Plains differs from that of the surrounding regions to the east and north, a locality to the north, one to the northeast and one to the east were studied. To the northeast at Guymon, in the "Panhandle" of Oklahoma, a strong tincture of forms from the lower country to the east and in Texas was evident. The variety of species and abundance of individuals made Guymon an interesting locality, one of absolutely level plains with richer vegetation than in the Kansas Great Plains. Dalhart, Texas, was the locality to the north of the Staked Plains, and Childress, Texas, the one to the east. With an elevation of little more than 2000 feet the latter locality showed but a weak plains element, with a strongly indicated central Texas influence. After the high plains Childress was quite hot, while its human inhabitants showed a similar relationship to that of the fauna, i. e. central Texan and not Great Plains.

Staked Plains at Happy Crossing, Palo Duro Canyon, near Amarillo, Texas.

The Staked Plains of Texas and eastern New Mexico next occupied our attention, using the term for the area east of the Pecos and south of the Canadian Rivers, as generally restricted. The surface of the Staked Plains is monotonously level with no true trees except where planted, and shrubby growth, such as mesquite, in relatively few areas. There is little surface running water, but the few streams which penetrate or rise in this region have carved deep and broad gashes in the limestone surface of the Plains. One comes suddenly and without warning upon these canyons, which are sometimes several miles wide and some hundreds of feet deep. In their bottoms are groves of good sized trees, chiefly cottonwoods, along a channel which carries a trickle of water, swelling after rains to a considerable stream. Palo Duro Canyon, near Amarillo, is such a place, and there, along the Prairie Dog Fork of the Red River, we spent some most interesting and profitable hours. The fauna of these canyons, like their flora, was probably derived in large part from country lower down stream, and represents an extension into a region of very different conditions on the plains level. At Amarillo, Mr. Hebard joined the writer, and six localities in the Staked Plains were carefully studied.

The vicinity of Canadian, Texas, in the valley of the Canadian River proved to be a most interesting district. North of the river were high sandhills, which would strictly be called "Great Plains" on account of their position and general character, while the bluffs on the South side of the river were virtually the north escarpment of the Staked Plains. On the bluffs we had the good fortune to take some greatly desired specimens of a most interesting "crackler" grasshopper, a northern type which had never before been taken in Texas. The genus to which this species belongs has the interesting habit of performing aerial dances and while so doing giving a sharp penetrating crackling note. This is accomplished by the rubbing of certain thickened veins of the wings one over another, and some of the species have very different notes, recognizable at once to the close student. As this is one of the genera which we have been critically studying for some years its presence is always a guarantee of excitement, for the insects are very active and generally wary, while the rocky and often dangerous slopes which they frequent are not preferred places for the necessary acrobatics. On the sandhills at Canadian many very interesting things were taken in their grass cover, and mantling thickets of wild grape and other plants. One of the strangest and most striking katy-dids found in the United States, was found in fair numbers in the tangles of grape vines. It is a vivid green and cream colored insect, incapable of flight but with extremely large and powerful jaws, which it is very ready to use. Outside of our own collection very few specimens have been taken of this genus, which occurs at a number of localities in Texas and also in northern Mexico. The jaws of several of the species are so powerful they are capable of nipping a piece of flesh from one's finger, if you are careless enough in handling the creature to permit it to get its bull-dog grip.

From Clovis, New Mexico, the last of the Staked Plains centers from which we worked, a side trip of several days duration was made into the Pecos Valley of New Mexico, our object being to ascertain to what extent this valley was penetrated by the Chihuahuan or Eastern Desert influence, as found in the El Pasan region of extreme western Texas, an area with which we were very familiar. The indications of this influence were marked, even at Roswell, the most northern of the two sections examined, while about Carlsbad, some distance down stream, the hillsides were well clothed with creosote bush (*Covillea*), cat-claw (*Acacia*), ocotillo (*Fouquieria*) and sotol (*Dasylirion*), all showing the extension of this truly desert element from regions to the southward. The Orthoptera showed as clearly as the plant life the nearness to the Rio Grande region of western Texas, where we had spent much time in the past twenty years. An old friend among the plants of western Texas, the black brush (*Flourensia cernua*), was found near Carlsbad, and search made at once for a most striking genus of grasshopper, which we had discovered some years ago was almost entirely restricted to it as a host plant, finally brought our little acquaintance to light.

From the Pecos Valley a long zig-zag journey was made to the first station of the Colorado section of our trip, a journey which took two nights and a day and a half of nearly continuous travelling, although the actual air-line distance was not more than four hundred and twenty-five miles. A lay-over of part of a day at Pueblo, Colorado, enabled us to do some work on the "bench" near that stricken city. Pueblo was just lifting its head and gathering its strength for the terrific task of rebuilding and rehabilitation after the really terrible floods of June, 1921.

The usual summer crop of Colorado mountain wash-outs had been reported for a very large part of the territory we wished to examine in that state, and as we traveled by night from Pueblo to Salida by train through steady rain it seemed that the reports were justified. Fortunately, however, we were not seriously delayed at any point by rains or washouts, and it was possible for us to carry out all of our tentative plans, in fact to make several additional productive side trips. Salida is in the valley of the Arkansas

River, at an elevation of about 7000 feet. To the west the Saguache Range towers, here forming the Continental Divide, with Mt. Princeton dominating the landscape to the northwest, while the east side of the valley is flanked by the Park Range. From Salida as a base studies were made and collections secured at points on the east side of the Divide to the summit of Monarch Pass, at 11200 feet, and for a distance down on the western side of the range. From the juniper and piñon clad foothills about Salida one passed upwards through forests of pine, gloomy stretches of spruce and fir, with many patches of paler green of the aspen thickets, while at the summit of the Pass the prostrate timber-line pines struggled for a few hundred feet higher on sheltered slopes and then gave up the struggle, leaving the ridges of decomposed granite bare and wind swept. The view to the west from the Pass is tremendous in its scope, and most of the higher mountain peaks of southwestern Colorado can be seen, although some are far distant. To the south towered Mt. Ouray, and to the east sharply cut Mt. Shavano dominated the landscape. At the summit we found one of the great desiderata of the trip, a species of grasshopper which had not been secured since the time of its description, nearly fifty years ago. Here it was in numbers, and it is now possible to study the insect from properly prepared material, instead of shrivelled alcoholic-preserved specimens.

From Salida we crossed the Divide by the famous narrow-gauge railroad over Marshall Pass, at 10856 feet, and then down the valley of the Gunnison River to the town of Gunnison. Gunnison is virtually surrounded by mountains, many with visible patches of snow at the end of August. The West Elk Range to the northwest and the Cochetopa Hills to the south are particularly impressive mountain masses. Gunnison is rather high, about 8000 feet elevation, and as one follows down the river he enters the remarkable Black Canyon of the Gunnison, which, on account of the lack of space for a roadbed, the railroad must leave, by way of a side canyon climb up and over a divide, then run down into the valley of the Uncompahgre. Here with Montrose as a center we examined conditions ranging from the irrigated land of the bottoms to juniper and piñon covered hillsides. The driving of the Gunnison Tunnel, a masterly project of the United States Reclamation Service, has turned the vicinity of Montrose into a thriving agricultural community, as the abundant water supply of the Gunnison River is carried through a six mile tunnel under a mountain range, and helps the otherwise inadequate water supply of the Uncompahgre River irrigate the fertile and extensive Uncompahgre Valley. To the south of Montrose, and hemming in the valley in that direction, one sees the jagged outlines of the San Juan Range, as saw-toothed as any range of great size in the United States, of far greater charm and variety than the main chain of the Rockies generally seen by the tourist. To see the San Juans one must go off of the main arteries of travel; there is no doubt in our mind but they will feel repaid for the experience. For our San Juan work the mining town of Telluride was our center. Here at 8800 feet the nights are cold, even in early September, as you are virtually at the head of the box canyon of the San Miguel River, the smelter-polluted water of which rolls its gray course over a cobbly bed. In every direction but to the west Telluride is encircled by high mountains, and our work carried us from the vicinity of the town to the summit of St. Sophia Ridge at 13100 feet. Several great and famous gold mines were on our route, the "Smuggler" and "Tom-Boy" particularly, while the "Liberty Bell" was nearby. Above the "Tom-Boy" mine, at 11500 feet, we passed the last of the timber and from there upward

LOOKING NORTH-EAST FROM ST. SOPHIA RIDGE, SAN JUAN MOUNTAINS, ABOVE TELLURIDE, COLORADO. ELEVATION, 13,100 FEET.

our course was in the Arctic Alpine Zone. Pikas, those queer little cousins of the rabbits, which affect such environments in our western mountains as well as those of northern Asia, bleated from most every slide rock slope, while the large marmots, close relatives of our woodchuck of the East, whistled from lookout points. Those cheery little bird sprites of the high mountains of our West, as well as those of the northern Old World, the leucostictes or rosy finches, made up the bird life of these bleak altitudes, but my greatest disappointment was at not seeing ptarmigan. I have been in ptarmigan country a number of times, but a sight of the bird in life has never been my privilege.

On the summit of St. Sophia Ridge we went through a chilling and dispiriting hail-storm, which numbed one to the bone, but fortunately it passed quickly and our work in the alpine meadows a few hundred feet below the ridge made amends for our stiff fingers. Our work at high altitudes in the San Juans gave us greatly needed data on two strictly alpine species, while the distributional information secured on a number of others is invaluable.

Leaving the high San Juans our activities were transferred to the lower or more desert sections of southwestern Colorado and adjacent New Mexico. At Mancos, near the Mesa Verde National Park, and about Durango, in the Animas Valley, we studied the orthopterous fauna of the juniper and piñon hill-slopes of this section of the state, as well as the yellow pine region of the Animas Valley above Durango, toward Silverton. A side trip to Farmington, New Mexico, in the San Juan River Valley, was of very great interest, as it is in a desert region of about 5500 feet elevation, but one which, when better means of communication are established, will be a great agricultural district, as the valley is wonderfully fertile when irrigated. Water here is not the major problem, thanks to the high mountains to the north in Colorado. Into this region from the southwest, from the country of the Painted Desert of Arizona, has entered a fauna alien to most of New Mexico, and in our own field of activities the evidence of this was very interesting. To the westward down the San Juan stretches seemingly limitless level country with scattered mountains, while sharply cut, like a pinnacle, the distant crag of Shiprock rises—a spire in the desert.

Chama, New Mexico, in the pines at the west foot of the Continental Divide, and Los Piños just east of the same, were our next points, and from Los Piños, at 9600 feet, the summit of the Cumbres Range, at 11200 feet, was reached. The whole character of the Cumbres region is different from that of the Saguache Range to the north or the San Juans to the northwest. It is a mountain region of more rounded outline, with the forest cover more "spotty." In an alpine meadow at Los Piños we secured a splendid series of a genus of grasshopper unknown before from the entire region of the Rockies. Snow was threatening at Los Piños, and it was quite evident September eleventh was near the end of the working season for us in such elevations in Colorado.

A brief stop made at Alamosa, in the upper Rio Grande Valley of Colorado, brought to light species of the New Mexican section of the valley, here nearly three thousand feet higher than previously known. Another day spent on the plains near Pueblo added some desired information and much needed material of several scarce or local species to our series, and on September sixteenth we reached Philadelphia after a very successful field season. Approximately eight thousand Orthoptera were secured, as well as a number of other insects, while the field notes and observations made represent in scientific value even more than the specimens taken.

OUR SOUTHERN HIGHLAND STREAMS AND THEIR FISH LIFE.

By HENRY W. FOWLER.

A hasty journey was made by the writer and his brother, Edwin Fowler, in the interests of the Academy during the month of October, 1921, to the larger streams and their tributaties, which traverse our South Atlantic and Gulf States, heading back in the ridges of the Alleghanies and winding their way across the Piedmont Plateau and the Coastal Plain. This is a region proverbially rich in fishes and from which came many rare and little-known species discovered by the earlier American ichthyologists.

We were successful in securing about three thousand specimens representing upwards of fifty species, a number of which are very rare in collections and known only from the meagre descriptions of their discoverers. The richness of the fauna was a constant de-light to one familiar only with the comparatively limited life of our more northern streams and the ever present possibility of bringing to light some rare and especially desirable specimen kept our enthusiasm at a high pitch.

Crossing the mountains at Bristol, Tennessee, we passed down the valley of the Tennesee River. The country here, as one sees it from the window of a railroad car, is rather monotonous. The grades we meet are not very steep, except in comparatively few sections. In mid-autumn the brown grass was everywhere in evidence, for the season of 1921 was dry in the extreme. The mountains comprising the outcroppings of the Great Smoky Range and finally Lookout Mountain bring us eventually into the tortuous gorges and abrupt slopes of the Cumberland Plateau, at the approach of the big bend of the Tennessee. These places often remind us of our beech-woods in upper Pennsylvania. Great masses of limestone boulders are strewn about and their white color frequently forms pleasing contrasts with the green verdure. When one ventures afoot into the forests the difficulties of travel are more apparent. Most of the trees on the hills are of moderate or small growth, and largely hard wood. Passing further west the valleys widen and finally we wind about on a level plain with only here and there large hills often "hog-backs," in endless profusion. The country soon becomes more level and the hills are left far to the north and the northeast.

About Decatur we stayed for several days and found most interesting conditions. The Tennessee River is here quite a wide and rather shallow stream and we imagine always soiled or muddy. At least several weeks of dry weather had left it in this condition and we found conditions about the same at most every point that we visited. Quantities of mussel shells, many large and quite thick, are carried ashore in the sand brought in by the river dredges. We were able to examine a number of species, some very attractive in form and color. Fish are taken by the river-fishermen, who have only a local market for their catch. At different points along the river we saw their shacks, and the large heavy fyke or set-nets, hanging in the branches of the trees. The fishing season is carried on with greatest success in the winter, when the river is high. Then great numbers of large cats, buffalo-fish, red-horse, river-suckers, grindles, eels, herring, pike-perch, rock-bass, strawberrybass, goggle-eyes, dollardees, etc., are caught. Occasionally one sees a large river catfish brought in, and the head of one we saw must have been from a fish weighing at least fifty pounds.

The level country along the river is often full of ponds, sloughs and bayous. These may extend from only a few rods to a mile or so in length, and vary according to their surroundings. In all of them, the water is constantly muddy. One sees usually but little life in these places, except close to shore where the little top-minnows swarm in myriads. Of the smaller ponds, many had dried up and we were able to walk over their sun-baked and cracked surfaces, with here and there traces of fish, mussels or other animals which had perished as the waters receded. In the larger lagoons or lakes, as they are called, the angler goes forth for the large-mouth bass. He uses a small boat fashioned like a narrow shallow river scow, and with a wooden paddle moves to the desired haunts of the bass. These fish are taken of fair and sometimes large size. The artificial minnow, spoon or plug, bristling with a shower of deadly hooks is most in use. A good angler will often cast far ahead to some favorite haunt of a particular fish. The bass usually strikes as soon as the plug reaches the water, or he may wait until further enticed by the little jerks given on the line as it is reeled in. This surely is a good imitation of a swimming frog and is usually rated as the most killing tackle. Often other fishes, especially the blue-gill sunfish, known everywhere as bream, goggle-eye, calico-bass and crappie, are also caught on lines, but with the baited hook. The large and curious spoon-bill sturgeon or paddle-fish, quite a characteristic feature of the deeper channels, is taken in nets. Kingfishers, herons, and cormorants were the usual water-birds of the region, while in the groves and adjacent woodlands we found the wood-pewee, red-bellied woodpecker and blue-jay, besides several brilliant warblers.

The river pond is often interesting in the greatly varying conditions presented. The water, with its more or less dull and muddied monotony, is frequently varied with sudden and pleasing contrasts. Due to the great diversity of light one is often astonished at the rapid change and apparent shift in the scene. If the air should remain perfectly still or without any breeze blowing, the surface of the water presents a solid broad covering well out from the shore line of rich bright green, truly algal green in all its luxuriance. In bright sunlight, or often in reflected lights, the tints are most brilliant and rich. Sometimes these so-called algal mats may extend the whole length of the pond. Often times the lagoons or lakes will appear perfectly clear or even with brilliant reflections in their muddy waters on bright days. In the early morning or late evening the effects of light and shadow often add still greater contrasts. Should the wind suddenly ruffle the surface the algal mat disappears as if by magic.

The tributary streams in the Tenessee valley of this section are interesting on account of the richness of the fish-fauna in their lowland reaches. In Limestone Creek we secured no less than twenty-three species in about an hour. This stream flows through many woodlands or brushy places, and in one locality we found small muddy pools left from the time of high water or floods, completely stocked with quantities of small fish, but it was only after dragging a net across one that we were aware of any life beneath the brown water. About the swamps and woodland were many large magnolias, often with great swollen roots and trunk bases. Here and there were mocking birds, cardinals, small flocks of doves and an occasional red-shouldered hawk.

PAINT ROCK CREEK, ALABAMA.

The most interesting of the Tennessee tributaries was Paint Rock Creek, further up in the foothills. At the village of the same name this stream furnished power for an old and picturesque mill.

Large bales of cotton were brought here, picked in the near-by cotton fields. Cotton and corn appear to be the only crops, with the addition of some cane, in places. The water in the Paint Rock was comparatively clear, and less muddy than in most of the water-courses of the region, or for instance the deep muddy trough of the Flint River. Several miles either way the Paint Rock Creek has high steep banks, mostly covered with tangles of briars and dense vegetation. The water itself was often choked up with snags, roots, rocks, etc., flowing usually over clay bottoms.

CEDAR CREEK, GEORGIA.

About the shallows below the dam we found the only submerged aquatic plants, clusters of *Myriophyllum*, etc. Consequently the only fishes were free-swimmers, though cats and various suckers were said to be abundant.

Passing over into the upper tributaries of the Alabama River basin in upper Georgia, the conditions are more like those of the upper or mountainous regions in which the Tennesse originates. These headwater streams all have a south-westerly course, and flow down through the various valleys south of Lookout Mountain. As typical of the Coosa basin we visited Cedar Creek, below Rome, and followed it through several miles of interesting country. It is a truly beautiful stream, the water of rather bright green color, perfectly clear and pure, and with riffs and little cascades about every span of several hundred yards. The stream is rather rapid, though stony and shallow in places. The minnows peculiar to this stream are beautiful bright silvery species, and on account of the conspicuous black spot at the base of the tail known locally as spot-tails. Most of the fishes we found were active, though weak little forms, the darters and sculpins being few.

About Atlanta one comes in contact with a number of interesting headwater streams, like those of the Chatahoochee to the north and west, or the watercourses flowing across the Coastal Plain into the Atlantic. Most settlements near the city deposit their sewage in the near-by streams, so that many are now in various stages of pollution and the fishes have largely if not entirely disappeared. In a mill-pond a few miles distant from the city, interesting pond conditions have developed. A patch of the arrow leaf (*Sagittaria*), still with some bloom, was growing in a few places along the shores. Roach, catfish, bream, tadpoles of various species, and great numbers of crawfish, were met with, though all pale or very dull in color.

The headwaters of the Oconee River near Lula comprise chiefly a small brook, cold and spring-fed. This flows through the gently rolling country over bottom-lands composed chiefly of gravel and red clay. It is often difficult to approach, due to thickets and dense areas of bushes and shrubs. Great tracts of pine forest, more or less clear and open, render approach in other sections easy. Running over the pine-needles or along fallen tree-trunks we found a few pine-tree lizards. Along the brooks the only frog seen was the spring-frog. The usual fishes were great numbers of the little red-chub, and a beautiful little darter largely blue-green in color. The streams tributary to the upper waters of the Savannah River basin, like those of Toccoa Creek, closely resembled the Oconee. They traversed more mountainous sections and usually had more rapid rocky tributaries. Often these little streams were of rapid cold water, flowing down over boulders and large rocky ledges with occasional waterfalls. Quantities of fish, all free-swimmers, as horny-heads, red-chubs, etc. were found here.

In the Santee Basin, the upper Saluda River, near Piedmont, South Carolina, is a great muddy trough, with steep banks, mostly well overgrown. The river fishermen here capture quantities of the channel species, as suckers, the so called "white-carp" or carp-suckers, cats, eels, chubs, various sunfish, yellow-perch, etc., with set-nets or lines, as few places will permit the operating of hauling-nets. In the small tributary brooks, the smaller and weaker cyprinoids are abundant and often occur in shoals within favorable little estuaries. Though great schools may sometimes be met with in such places they usually consist of but few species, sometimes entirely of one. Above Spartanburg the Pacolet River is a wide, muddied, stream at the mill dam. Following down from the dam are many shallow pools, the banks and portions of the stream choked up with bushes, logs, limbs, snags, gravel bars, etc. Many large rocks are also strewn about. The town has in no way improved the situation with its generous contributions of refuse, old tins, cast off utensils, and other trash.

The Dan River at Danville, Virginia, is obstructed by several concrete dams and spanned by as many long bridges. The dams result in a succession of shallows, and below the cascades the rocks are all worn down. The larger pools contain carp, suckers, cats and sunfish, etc. In two tributaries near the town, the water is of great clarity, and flows over a broad, gravelly or sandy bottom. Usually one meets with but few snags or roots here though everywhere are shoals or bars. The fish in these streams are exceedingly abundant, frequenting mostly the little eddies or backwater pools, usually about the bends. A great variety of brilliant silver-fins, red-fins, painted-minnows, etc., were found, sometimes in great schools.

The wild mountainous regions of the southern Alleghanies will always have a charm, all their own, to the naturalist or rambler. It was our fortunate experience, to see this country during the finest season of the year, October, when it was at its best. The long hot summer having passed there was just enough tone or snap to the air to render it exhilarating, if not actually stimulating. This, and the fact that the sun shone at least part of each day if not all day long, afforded us splendid weather afield. The great watercourses and their hosts of tributary streams, with all their wonderful array of fish-life, the richest in all the fresh-waters of the United States, will long remain to a large extent a terra incognita to the ichthyologist. He will require untiring energy and exertion to even partially explore this vast field. We therefore feel that our own modest effort will be crowned with success can we but induce others to carry forward where we have but momentarily paused.

THE SIERRA LA SAL, UTAH.

By HENRY SKINNER, M.D., Sc. D.

Some years ago, while on a collecting trip in the Wasatch mountains of Utah, I was told of another range of high mountains in the southeastern part of the State. They were said to have an abundant and rich vegetation and to be well watered by streams and some lakes. A locality of that description should have an interesting insect fauna and, so far as I knew, it had never been visited by an Entomologist, and I determined to go there some day if possible.

EIGHT HOURS TO GO TWENTY MILES.

In the spring of 1920, Mr. R. A. Leussler, a well known Lepidopterist, of Omaha, Nebraska, informed me he wished to go on a collecting trip and we planned to go to the Sierra La Sal. The conditions one may encounter are an unknown quantity and we did not know whether we would need guides, horses, or a camping outfit. Usually it is wise to get as much information as possible in advance but to a certain extent we decided to be governed by conditions as we found them. We did however, receive information about the country from the postmaster at Moab, the agent of the Denver and Rio Grande Western Railway at Thompson, and the La Sal Live Stock Company, at La Sal. I found Mr. Leussler at his home in Omaha, ready and enthusiastic. Our first stop was made at Glenwood Springs, Garfield County, in western Colorado, which is the type locality of some interesting and rare butterflies. Collections were made in the nearby mountains on July 11th, 12th, and 13th. This was an enjoyable break in the journey on our way to Thompson, Utah, where we arrived about noon on the 14th. This is a small railway place and as we approached it we could see the Sierra La Sal about sixty-three miles distant.

The Wilson Mesa.

The road from Thompson is largely two deep ruts in the sand of a typical desert country and the distance to Moab is 38 miles. An automobile stage line runs between the two places. The journey over the desert plain was not devoid of interest but the scenery improved as the canyon was reached that leads to Moab and the Grand river. The sandy areas are not entirely devoid of vegetation and sage-brush and shad-scale are scattered about. Moab is a small oasis and has a population of about 600 and is situated on a creek that runs into the Grand river. Its altitude is 4,000 feet and the valley is surrounded by high cliffs that remind one of the Grand Canyon of the Colorado. The natural flora is of a desert character but many fruit and other trees, as well as a variety of crops, are raised by means of irrigation. Along the river may be seen a number of kinds of trees, including *Salix*, *Rhus*, *Populus*, *Celtis*, and *Rhamnus*. The people we met in Moab were very pleasant and gave us all the information in their power.

THE SANDSTONE FLATS.

The postmaster, Mr. Shafer, has a married daughter living in the mountains and through him we arranged to go to the ranch of Mr. and Mrs. John W. Sullivan and make it our headquarters during our stay. Through the kind efforts of Mr. H. W. Balsley, a Moab banker, we secured a team to take us to the Wilson Mesa where the Sullivans lived. Some idea of the going from Thompson to Moab may be gleaned from the fact that it took nearly three hours to make the 38 miles in an automobile and the journey to follow promised to be much worse. We were warned that the so-called sand flats had many disagreeable features and that it would take about eight hours to reach the Wilson Mesa and the distance was only twenty miles. The road from the town runs along Pass creek and a short stop was made to gather some ripe apricots that helped to quench thirst later on. The sand-flats and sand-hills were soon reached and made me think of a character in one of Captain Marryat's stories, who said he had visited regions where beef-steaks could be fried on the rocks and this was the first time I had thought such a thing might be possible. As we went on our way there was a marked difference in the character of the country and the change from the desert valley to the sand-flats was full of interest; and then came the sandstone hills and in the distance was the snow glistening near the tops of the peaks.

Hundreds of Acres of Sandstone.

There are immense sandstone masses, often jagged and castle-like on top and in other places many acres of stone nearly level. These places have small plants where there is a little depression that will hold earth or moisture. The foot-hills contain many low shrubs, *Amelancher utahensis*, *Cerocarpus montanus*, *Coleogyne*, *Petradoria*, *Yucca*, *Nuttallia*, *Fendlera*, *Ephedra*, *Gutierrezia*, *Cowania*, *Quercus*, and other species and genera abound. Higher up are the cedars, pinyons, aspens and spruces.

Some of the lower levels were very bare and stony and to reach the sand-stone flats we went through some narrow, rocky passes that appeared almost impossible. Hundreds of acres of sandstone were in view and in places it assumed fantastic forms, like human beings turned to stone and domes and castles were not uncommon.

DOMES AND CASTLES WERE NOT UNCOMMON.
A REMARKABLE BALANCED ROCK (LEFT OF DOME).

A remarkable balanced rock was seen some distance away, that must have weighed many tons. It was in the form of an inverted cone and the point of the cone was so attenuated as to look needle-like. It was by far the most interesting balanced rock I had ever seen. There was a dearth of animal life but a close examination would probably have disclosed more. A white butterfly (*Pieris*), a moth-like butterfly (*Megathymus*), a grasshopper, and a hawk, were the only creatures noticed, with the exception of an alert animal on the hot rocks, a lizard about a foot in length, of great beauty, being a brilliant metallic green. Three or four were seen but we had no way of capturing them.

There was a cold spring about half way to the mesa and we stopped there for lunch and the menu was the usual one on such occasions,—coffee and sandwiches. The spring-water for dessert in the desert was a real treat. From here the way was through the cedar and pinyon until we reached the Wilson Mesa, covered partly by chapparals and scrub-oak, except where cleared for the cultivation of alfalfa.

DEEP CANYONS THAT WERE NOT SEEN UNTIL REACHED.

We arrived at the Sullivan Ranch at 7:30 P. M., had a wholesome dinner and retired for the night. This place is at an elevation of about 6200 ft., and here the days are warm and full of sunshine and the nights quite cool. Twelve days were spent in the mountains collecting. Mr. Leussler confined his attention to the Lepidoptera, while the other member of the party took in all the orders of insects.

The sombre butterfly, *Satyrus paulus*, was abundant in the scrub-oak and not infrequently alighted on the bark. It is a wary creature, with its jerky flight, but we manged to capture a nice series. A little higher up, in a draw or small canyon, we found *Thecla crysalus*, a butterfly of an unusual shade of blue. Grasshoppers of a number of species were in evidence, but other insects were scarce in comparison with the much richer Wasatch mountains. From morning until sundown we explored within a radius of some miles, as far as we could cover on foot in a day, but the high mountains were still beyond and lured us on. After going up rises of hundreds of feet we found other hills still beyond and deep canyons that were not seen until their edges were reached. In the distance impenetrable oak and aspen thickets looked like well-cropped lawns. Peaks that looked as though one might walk to them in a few hours were days away and had to be reached by circuitous routes by means of saddle and pack horses. In a beautiful little valley at 7000 feet, almost hidden by aspen and fed by a splendid spring, we found the true *Argynnis chitone*, one of the silver-spotted butterflies. About a thousand feet higher a species of moth (*Pseudohazis*) was flying; it has a flight much like a *Papilio*. On the 23rd of July, after due preparation, we started on our trip to the higher altitudes. Mr. and Mrs. Sullivan also concluded to take a vacation, as they were fond of camping and outings in the mountains.

Four good saddle-horses and a pack-animal were a part of our necessary equipment. The weather was ideal and the mountain scenery very beautiful.

The La Sal is a National Forest Reservation and our objective point was the Warner Ranger Station at an elevation of 9,490 feet. From this point we could see the top of one of the big peaks rising some thousands of feet above us. Here were some interesting stands of forest trees and in the glades we again found the silvered butterflies and other species not taken at lower levels. A night and part of a day were spent here and then we went still higher to the saw-mill, where we wished to collect, at 10,000 feet altitude. From this place we had an excellent view of Mt. Peale which rises to 13,089 feet. Engelmann spruce grow to a huge size at this elevation and we saw some specimens that may have been three hundred years old. The tops of the mountains are bare and covered with talus, but plants such as *Polemonium confertum*, *Erigeron trifidus*, *Arenaria obtusifolia*, and *Claytonia megarrhiza* grow at high altitudes. At the saw-mill were many beautiful clumps of flowering plants, among them a columbine which had very large flowers, and these clumps sometimes covered several hundred square feet. Many acres were made yellow by the blooms of *Dugaldia hoopesi.* A tall larkspur was in bloom and the flowers were lovely but the plant is very poisonous to cattle and we were told that a number had been killed by eating it. The forest here is very attractive and extends upward to an altitude of somewhat over 11,000 feet.

The Sierra La Sal in the distance.

Not having any other place available, we slept on the carpet of humus in the virgin forest. It was cold at night, 45° F., and the mosquitoes were numerous and hungry. By using a butterfly net, over a cap, and fastened above the shoulders, sleep was obtainable. The greater part of the next day was spent in collecting at this high altitude, but nothing new or very rare was secured. The return to the mesa was made by another route and it took seven hours to go thirteen miles. Some time after we left, a terrific hail and rain storm began in the peaks and their tops were soon white, and then the floods began and came pouring down the arroyos, and at one place we crossed an arroyo with great difficulty. A little later while the others of the party were ahead, having safely crossed one of these danger places I heard the flood coming. I was leading my horse at the time and rushed forward, managing to get through the first rush of water with a second or two to spare. The water was the color of chocolate, loaded with small stones and other debris. A moment too late would have meant being drowned or marooned until the mad flood subsided. I was told that several persons had lost their lives by arroyo floods in these mountains. July 28th. we left for Moab and Thompson and found the temperature 96° in the shade; and the train we intended to take for Salt Lake City was seven hours late. The canyons around the City of the Saints are entomologically rich, far more so than in the Sierra La Sal. At the former place about 115 species of butterflies have been recorded. Returning we spent a few days at the higher points on the Union Pacific Railway, Evanston, and Laramie in Wyoming. We enjoyed our stay in the Sierra La Sal. The mountains are of interest to the geologist and mineralogist as well as the botanist and zoologist. The highest mountains are Mt. Peale (13,089 ft.), Mt. Waas (12,586), Mt. Tomasaki (12,271), and Tukuhnikikivatz (12,004 ft.) This last name is of Navajo origin. Carnotite, the ore of radium is mined, as well as gold and other metals and minerals.

In the summer of 1911, P. A. Rydberg collected botanical specimens in the Sierra La Sal and I know of no other naturalist who has visited them.[1]

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[1] See: Journal New York Botanical Garden, XII: 143. 1911.

ADMINISTRATION OF THE MUSEUM

BOARD OF CURATORS.

WITMER STONE, *Executive Curator.*	HENRY A. PILSBRY, *Secretary.*
HENRY TUCKER,	GEORGE SPENCER MORRIS.*

SCIENTIFIC STAFF.

Vertebrate Zoology.

WITMER STONE, *Special Curator.*
WHARTON HUBER, *Assistant Curator, Birds and Mammals.*
HENRY W. FOWLER, *Assistant Curator, Fishes and Reptiles.*

Mollusca and other Marine Invertebrates.

HENRY A. PILSBRY, *Special Curator.*
EDWARD G. VANATTA, *Assistant Curator.*

Insects.

HENRY SKINNER, *Special Curator.*
JAMES A. G. REHN, *Assistant Curator.*
E. T. CRESSON, JR., *Assistant Curator.*
MORGAN HEBARD, *Research Associate.*

Plants.

FRANCIS W. PENNELL, *Special Curator.*
BAYARD LONG, *Research Associate.*

Minerals and Rocks.

FRANK J. KEELEY, *Curator of the William S. Vaux Collections.*
SAMUEL G. GORDON, *Assistant Curator, in charge of the General Collection.*

Archeology.

MISS H. NEWELL WARDLE, *Assistant Curator, in charge.*

Ludwick Department of Public Instruction.

HAROLD T. GREENE, *in charge.*

Taxidermist.

DAVID MCCADDEN.

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*Deceased April 12, 1922.

Report of the Curators.

The Museum halls have been open free to the public as usual throughout the year with a constantly increasing attendance especially on Sundays and lecture days.

Notable among the specimens received for exhibition have been a series of beautifully mounted heads of African game animals deposited by Mrs. B. C. Madeira, and several others presented by Mr. Edward Browning. Also a fine specimen of the rare giant spider-crab of Japan presented in the name of Edward Russell Jones by Mrs. Edward Russell Jones.

At the very close of the year it was possible to secure the services of Mr. Harold T. Green to take charge of the Ludwick department of Public Instruction, the objects of which were outlined in last year's report, and plans are already under way for increasing the educational value of the museum.

Two handsome exhibition cases have been provided through the generosity of a member for the further display of specimens in the Archeological Department.

Early in the year the Academy suffered a severe loss in the death of Stewardson Brown, for twenty years in charge of the Herbarium. Largely owing to his faithful care the historic collections contained in this department of the museum are now in an excellent state of preservation and readily available for study. On October 1, Dr. Francis W. Pennell was appointed Special Curator of Plants to fill Mr. Brown's place, and Mr. John M. Fogg Jr., was appointed a student on the Jessup Fund to act as an assistant in this department.

In the department of Vertebrate Zoology Mr. Wharton Huber was appointed an Assistant Curator in charge of birds and mammals. Owing to the constantly increasing duties of the Executive Curatorship, Dr. Stone has been unable during the past several years to give these collections the care and attention that they required, and the appointment of Mr. Huber has resulted in bringing them into excellent order.

The usual amount of local field-work has been accomplished by members of the scientific staff and several more extended expeditions have been successfully carried through.

Mr. Samuel G. Gordon, in charge of the mineralogical collections, was given leave of absence from May 28 to November 15 for a trip to South America in the interests primarily of the William S. Vaux Collections, the remainder of the support being provided directly by Mr. Gordon, and from the disposal of duplicate specimens which he obtained. He traversed the Andes of Ecuador, Peru, Bolivia, and Chili, visiting many of the more important mines and securing a large amount of material, both minerals and rocks.

Through the generosity of Mr. Morgan Hebard it was possible for Mr. Rehn to accompany him on a trip of six weeks through portions of Texas, New Mexico, Kansas, and Colorado, on which a large collection of insects, mainly Orthoptera, was obtained.

Dr. Pilsbry spent part of the summer in studying the molluscan fauna of Lake Champlain and the adjoining portions of the Adirondacks, and secured several thousand specimens.

Mr. H. W. Fowler visited during the month of October the principal streams flowing from the southern Alleghanies, and secured some three thousand specimens of the freshwater fishes inhabiting the region; while Dr. Stone made a short trip into the mountains of eastern Kentucky obtaining a series of the early spring plants and a collection of the land mollusks, besides much information regarding the distribution of life in this little-known region.

Mr. Clarence B. Moore continued during the winter his archeological exploration on the west coast of Florida and the Florida Keys.

Improvements in the museum building during the year include the building of a rest room for women, completing the improvements to the heating plant, rewiring the electrical connections in the lecture hall and library, the installation of a moving picture machine and erection of a closed booth for all of the projecting apparatus. The last improvement materially increased the seating capacity of the lecture hall.

A number of societies, mostly national in character, have held their annual meetings in the building during the year. These included the American Ornithologists' Union, the American Society of Ichthyologists and Herpetologists, the American Association of

Ophthalmologists and Oto-Laryngologists. Local societies have also held their meetings at the Academy, including the Garden Clubs of Philadelphia, the Delaware Valley Ornithological Club, the Philadelphia Botanical Club, and the Philadelphia Mineralogical Club.

Details of work in the several departments and accessions for the year follow:

MAMMALS

Many valuable specimens have been received from the Zoological Society of Philadelphia which have been prepared either for study or exhibition.

The study collection has been carefully examined and poisoned preparatory to a thorough rearrangement.

BIRDS

A valuable collection of skins from the interior of Bolivia containing many species new to the Academy's collection was purchased from Mr. José Steinbach. A number of important specimens were presented by the Zoological Society including a kagu, a bird hitherto unrepresented in the collection. Many noteworthy local specimens were also received from various sources. The most notable accession, however, was the series of South American water-birds generously given by Dr. L. C. Sanford, being duplicates from the collection made for him by Rollo H. Beck, the main portion of which is in the American Museum of Natural History, New York. The collections have been extensively studied during the year by visiting ornithologists. The meeting of the American Ornithologists' Union brought to the Academy most of the leading ornithologists of the United States and Canada, who made free use of the specimens in their studies. Mr. H. Kirke Swann, the British ornithologist, also visited the Academy on this occasion.

During the year Mr. Huber has catalogued and labelled all of the accumulated material and distributed it through the collection. He has completed the labelling of the various cases, which greatly facilitates consultation. He also relaxed and restuffed many poorly made skins among the recent accessions.

REPTILES AND FISHES

Mr. Henry W. Fowler who has continued in care of the collections reports that he has examined during the year the entire series of reptiles and batrachians and about a third of the fishes, and has replenished the alcohol wherever necessary, so that this part of the collection is now in excellent condition.

He has identified all of the material received during the year and catalogued 73 reptiles and amphibians and 228 fishes. A paper has been prepared for publication on the sticklebacks, sea-horses and allied fishes in the Academy's collection.

Further notable additions are included in a collection of reptiles and fishes from Nicaragua from Dr. Theodore Bouchelle; and a collection of Formosan fishes from Dr. Masamitsu Oshima.

MOLLUSKS

Dr. Henry A. Pilsbry, Special Curator of Mollusks, reports that gifts of mollusks have been received from 79 persons, the more interesting accessions being a series of Venezuelan shells from Dr. H. Burrington Baker, and Madeiran shells, partly received alive, from Prof. T. D. A. Cockerell. Messrs. Ferriss, Clarke, Malone, Dr. S. S. Berry, and others, have continued to add to our North American series. The Special Curator procured some thousands of specimens from Lake Champlain and the adjacent Adirondacks.

Work on the monograph of Pupillidae has progressed to the completion of the subfamily Pupillinae.

Throughout the year Dr. C. Montague Cooke, of the Bishop Museum, Honolulu, has prosecuted his studies on the anatomy of Hawaiian land snails in the laboratory of the department. Dr. H. Burrington Baker, of the zoological staff of the University of Pennsylvania, has worked up collections made by him in Mexico and Venezuela, finding time also for comparative studies on the dentition of Helicinidae and Neritidae, the results of which have been submitted to the Academy for publication.

Mr. Vanatta has rendered efficient service in taking care of new material, and in a re-arrangement of the collection of fresh water mussels, which had outgrown the space formerly allotted.

Specimens have been loaned during the year to 12 naturalists in other institutions.

INSECTS

Dr. Henry Skinner, Special Curator of Insects, reports that 5526 specimens have been received during the year. The care and preservation of the collections has occupied most of his time, but a number of specimens have been mounted and incorporated. Research work has been carried on and a number of papers published.

During the year Mr. Rehn and Mr. Hebard have continued the rearrangement of the exotic series of Dermaptera and Orthoptera, the representation in certain groups being greatly augmented by the addition of recently studied collections.

Mr. Rehn completed his study of the Blattidae of the Transvaal Museum collection, and progress was made upon a comprehensive study of the West Indian Blattidae, and another of the African Blattidae of the Paris Museum. The Blattidae of the Indian Museum collection and the Acrididae of the Zoological Museum at Buitenzorg, Java, have been received for study by Mr. Rehn. From all of these, as well as numerous other invaluable collections previously received, the Academy will secure fully representative series for his services. Purely clerical work of the Recording Secretary's office has greatly restricted the time available for his studies. This it is hoped may be remedied in the not distant future by securing suitable clerical help for secretarial routine, so that the Academy may have the credit and returns accruing from the study of noteworthy collections submitted for examination to a member of its staff.

Mr. Hebard has completed a comprehensive study of the Dermaptera and Orthoptera of the Hawaiian Islands, to be published by the Bernice Pauahi Bishop Museum; also a study of the Dermaptera in the collection of the Agriculture Institute at Pusa, India. A report on the previously unstudied Mexican Blattidae in the collections here was also prepared by him, and he is at present engaged with the examination and description of extensive collections of Malayan and Papuan Tettigoniidae. He has also received for study the collection of Blattidae of the Pusa Agricultural Institute, all of the Hawaiian Dermaptera and Orthoptera of the Bishop Museum collections, as well as various smaller representations. He has also secured by purchase and otherwise important series of

Orthoptera from South America, Katanga in the Belgian Congo, British India, and the Phillippines, all of which will greatly increase our collections when studied.

PLANTS

Owing to the illness and death, on March 14, 1921, of Mr. Stewardson Brown, for twenty years Curator of the Herbarium, the department remained for most of the year without an acting head, though the services of Mr. Glenn were secured in cataloguing and distributing accumulated material. On October 1, 1921, Dr. Francis W. Pennell, formerly Associate Curator of the New York Botanical Garden, assumed charge, with Mr. John M. Fogg, Jr., as an aid.

Little change has been possible, so far, in the housing of specimens. The rearrangement of the herbarium is progressing as rapidly as facilities permit, and a further step toward making available for rapid reference will be the arranging of the specimens of each North American species in a definite sequence of countries and states. The North American specimens are now grouped in distinct covers for each species thus making the herbarium a systematic index of plants; the new arrangement of sheets will make it also accessible to students of limited geographic areas.

The new Curator has had little time for research but has given final preparation to a report on the Scrophulariaceae of Cuba. He has in partial completion other studies of the plants of this interesting family. A large number of specimens of Scrophulariaceae, from the Central Rocky Mountain States, and from Colombia, were brought on from New York for further study.

Mr. Bayard Long has continued his supervision of the local Herbarium. He has answered many queries, determined a large number of specimens for various collectors, and has done critical study on certain genera. During the spring he continued the naming of Yukon plants, collected by Mr. Adolph Muller and left in part identified by Mr. Brown. During the summer he was again a member of the Gray Herbarium Expedition for the botanical exploration of Nova Scotia.

MINERALS

Mr. Samuel G. Gordon who has had charge of the Mineralogical collections during the year reports that his time during the early part of the year was occupied with the investigation of Pennsylvania minerals and rocks and the preparation of a number of new accessions. Among the more notable of these was a collection of zoolites from the Perkiomenville quarry, in Montgomery County, presented by Messrs. Hilbiber and Tallis.

From May 28 to November 15 Mr. Gordon was absent on the expedition to South America elsewhere described.

During the year a Goldschmidt two-circle goniometer was purchased for the laboratory of the department.

ARCHEOLOGY

Miss H. Newell Wardle, in charge of this department, reports that another portion of the Gottschall collection, including costumes and weapons of the Apache and Kiowa and a series of Navajo blankets, has been placed on exhibition, while progress has been made in cataloguing other portions of this collection.

Mr. Clarence B. Moore's winter expedition to Florida resulted mainly in securing duplicates of shell artifacts which have been used in exchange with other museums for valuable collections from the Cliff-dwellings, the ancient Pueblos, and from Mexico, thus greatly enriching the department.

REPORT OF THE CURATOR OF THE WILLIAM S. VAUX COLLECTIONS.

During past year, the William S. Vaux Collections have been enriched by numerous accessions, the most important of which were the minerals collected by Mr. Samuel G. Gordon in Peru, Bolivia, and Chile, numbering about two-hundred-and-fifty specimens and including magnificent suites of brilliant, highly modified tetrahedrite, bournonite, enargite, wolframite, translucent cassiterite, bismuth nodules, as well as many rare species, some of which are new to the collection.

The following were gifts to the collection: Rutile, Rowlandsville, Philadelphia, Samuel G. Gordon; Quartz and beryl, Boothwyn, Pa., Thomas Harvey; epidesmine and natrolite, Perkiomenville, Pa., Frederick Hilbiber and John Tallis; gold pseudo. calaverite, Cripple Creek, Col., and sodalite, Ice River, British Columbia, George Vaux, Jr.

Forty-five specimens were purchased of which the following are noteworthy: a twin crystal of quartz, 14 inches in diameter, from Japan; unusually large crystals of native lead from Sweden; rhodochrosite from Franklin, N. J., transparent yellow orthoclase crystal and cut gem from Madagascar; and two individuals of the Richardton, North Dakota, aerolite.

Respectfully submitted
F. J. Keeley,
Curator.

ADDITIONS TO THE MUSEUM.

1921.

MAMMALS

MISS M. C. BOOTH. Skin of Short-tailed Shrew (*Blarina brevicauda*).

BRITISH MUSEUM, in exchange. Skins and skulls of *Caviella australis*, *Ctenomys luteolus*, and *Phyllotis ricardulus*.

HENRY W. FOWLER. Skin and skull of rabbit.

HEBARD-ACADEMY EXPEDITION 1919. Skin and skull of weasel (*Mustela streatori leptus*), Santa Fè Range, New Mexico.

S. N. RHOADS. Skin and skull of rabbit.

ZOOLOGICAL SOCIETY OF PHILADELPHIA. Skins and skulls: Bandicoot (*Peragale sp.*); Brazilian Tapir (*Tapirus terrestris*); South African Eland (*Taurotragus canna*); Cape Giraffe (*Giraffa capensis*). Skin of young Hippopotamus (*Hippopotamus amphibius*); Nail-tailed Wallaby (*Onychogale unguifera*); Bernard's Kangaroo.

BIRDS

DR. W. L. ABBOTT. Skins of San Domingo Savanna Sparrow ((*Ammodramus savannarum intricatus*).

W. L. BAILY. Skin of Saw-whet Owl (*Cryptoglaux acadica*).

O. H. BROWN. Skin of Cooper's Hawk (*Accipiter cooperi*).

WILLIAM BURWELL. Male Florida Gallinule (*Gallinula galeata*).

E. REHN CASEY. Skin of Barred Owl (*Strix varia*).

HENRY W. FOWLER. Skin of Double-crested Cormorant (*Phalacrocorax auritus auritus*).

MISS ESTHER HEACOCK. Skin of Screech Owl (*Otus asio*).

LEVI D. HOPPER. Four-legged chicken, Philadelphia.

WHARTON HUBER. Two bird skins.

J. G. KINLEY. Skin of Loon (*Gavia immer*).

D. MCCADDEN. Eight skins of Sora (*Porzana carolina*).

F. GUY MYERS. Two skins of Marsh Hawk (*Circus hudsonius*).

C. H. NEWCOMB. Two skins of Golden-eye Duck (*Clangula clangula americana*).

S. N. RHOADS. Skin of Starling (*Sturnus vulgaris*). Eighteen skins from Florida.

BOYD P. ROTHROCK. Skin of Eider Duck (*Somateria spectabilis*).

SAMUEL SCOVILLE, JR. Robin's nest with two eggs.

DR. HENRY SKINNER. Skin of Starling. Eggs and skin of Lady Amherst's Pheasant.

DR. WITMER STONE. Ten bird skins from New Jersey.

DR. SPENCER TROTTER. Skin of Hairy Woodpecker (*Dryobates villosus*) and Cooper's Hawk (*Accipiter cooperi*).

U. S. CUSTOMS OFFICE, PHILADELPHIA. Skin of Bird of Paradise (*Paradisea minor*) and 21 other skins.

DR. HENRY R. WHARTON. Skin of Red-throated Loon (*Gavia stellata*).

ZOOLOGICAL SOCIETY OF PHILADELPHIA. Female skin of Paradise Bird (*Paradisea raggiana*) and skin, with body in alcohol of Kagu, *Rhinochetus jubatus*.

AMPHIBIANS AND REPTILES

DR. THEODORE BOUCHELLE. Two collections of serpents from Nicaragua

J. N. CHRISTEE. Boomslang (*Dipsadophis typus*).

J. B. CLARK. Worm Snake from Clearwater, Fla.

MORGAN HEBARD. Collection from Michigan, Georgia and Florida.

HEBARD-ACADEMY EXPEDITION 1921. Jar of reptiles from Arizona and Texas.

W. C. HENNEBERGER. Fossil Gavial remains, Debeque, Col.

BAYARD LONG. Collection from Nova Scotia.

DR. HENRY A. PILSBRY. Two Rattlesnakes (*Crotalus horridus*) and salamander (*Desmognathus fusca*).

G. W. SULLIVAN. Young two-headed Water Snake (*Natrix sipedon*), Maryland.

FISHES

R. M. ABBOTT. Two fishes from oyster-shells, Rhodes River, Md.

DR. THEODORE BOUCHELLE. Collection of fresh-water fishes from Nicaragua.

HENRY S. DRINKER. Jaws of Great White Shark (*Carcharodon carcharias*) taken in 1920 at Beach Haven, N. J.

HENRY W. FOWLER. Several jars of fishes from Delaware, Pennsylvania, New Jersey.

FOWLER-ACADEMY EXPEDITION 1921. Sixteen jars of fishes, Alabama, Georgia, South Carolina, and Virginia.

G. W. GOUDY. Jar of fishes from Indian Lake, N. Y.

W. C. HENNEBERGER. Fossil fish remains, Debeque, Col.

HOWARD R. HILL. Jar of fishes, Pensacola, Fla.

WHARTON HUBER. Seven jars of fishes, Corson's Inlet, N. J.

J. G. MALONE. Egg-case of Big Skate of California (*Raja binoculata*), obtained at Newport, Oregon.

DR. MASAMITSU OSHIMA. Collection of fresh-water fishes from Formosa.

R. P. SCHRIVER, JR. Porcupine fish (*Diodon hystrix*), N. J.

CAPTAIN CHARLES SILVESTER. Six jars of Samoan fishes.

UNIVERSITY OF MICHIGAN, in exchange. Jar of lampreys and lancelet.

RECENT MOLLUSCA

DR. W. L. ABBOTT. *Pleurodonte undulata* Fér. from near Port au Prince, Hayti.

W. O. ABBOTT. *Tivela abaconis* Dall from Florida.

A. REGINALD ALLEN. Twelve trays of shells from New Hampshire and Pennsylvania.

AMERICAN MUSEUM OF NATURAL HISTORY. Land shells from Africa.

E. ASHBY. *Acanthochiton coxi* Pils. from Tasmania.

F. C. BAKER. Two species of *Lymnaea* from Wisconsin and Minnesota.

H. B. BAKER. One hundred and seventy-nine trays of shells from Colorado and Venezuela.

MISS M. G. BECKWITH. Three species of Hawaiian marine shells.

MISS L. G. BEEKMAN. Five species of marine shells from Ocean City, New Jersey.

DR. J. BEQUAERT. *Limicolaria saturata* Sm. from Mt. Ruwenzori, Africa.

S. S. BERRY. Paratypes of *Polita gabrielina* Ber. from California.

BERNICE PAUAHI BISHOP MUSEUM. Seven trays of Hawaiian land shells.

DR. S. C. BISHOP. Three trays of fresh water shells from New York.

DR. J. F. BRANSFORD. Two species of *Nerita* from Nicaragua.

LOUIS H. BREGY. *Oreohelix strigosa depressa* Ckll. from Zion National Park, Utah.

THE BRITISH MUSEUM. *Gastrocopta mooreana* Sm. from Roebuck Bay, West Australia.

W. A. BRYAN. One hundred and twenty-five trays of Hawaiian marine shells.

H. C. BURNUP. One *Ennea* from South Africa.

CANTON CHRISTIAN COLLEGE. Fourteen species of shells from China.

GEO. H. CHADWICK. *Nerita ornata* Sby. from the Canal Zone.

GEO. H. CLAPP. Eight trays of land shells from Alabama, Florida and Canada.

JAMES B. CLARK. Three hundred and eighty-six trays of shells from Cuba and eastern United States.

T. D. A. COCKERELL. Sixty-three trays of land shells from the Madeira Islands.

MISS EMILY COLLINS. *Cypraea erosa* L.

THE COMMERCIAL MUSEUM. Two marine shells from Barbados Isand.

DR. C. M. COOKE, JR. Four species of land shells from Arizona and California.

SHELLEY G. CRUMP. Seven trays of fresh water shells from New York.

DELOS E. CULVER. Three marine shells from the craw of a black duck.

A. W. FAHRENBRUCK. Four species of shells from Ohio and Canada.

SMITH L. FORMAN. Two species of *Nerita* from Gilberts Bar, Florida.

H. W. FOWLER. Twenty-five species of land and fresh water shells from Alabama and Pennsylvania.

L. S. FRIERSON. Type of *Amblema t. pentagonoides* Fr. from Lake Charles, Louisiana.

J. AND A. GOUVEIA. Six Hawaiian land shells.

DR. I. MINIS HAYS. Twenty-six species of shells.

MORGAN HEBARD. Ten species of marine shells.

J. B. HENDERSON. Two West Indian land shells.

JUNIUS HENDERSON. Twelve trays of land shells from Colorado and Wyoming.

H. C. HIGGINS. Three species of *Partula*.

HOWARD HILL. *Lolliguncul us brevis* Bl. from near Pensacola, Florida.

Wharton Huber. Two species of shells from the crops of birds.

Francis James. *Achatinella bulimoides* Sw.

F. J. Keeley. *Teleoteuthis caribbaea* (Lesr.) from Hawks Park, Florida.

Anna Keys. *Conus consors* Sby.

Philip Laurent. Four trays of shells.

Bayard Long. Eleven trays of land shells from New Jersey and Pennsylvania.

J. G. Malone. Seventy-three trays of Pacific shells.

D. P. Mannix. Three species of shells.

C. T. Mant. Nineteen trays of Hawaiian marine shells.

E. S. Marks. Fifteen trays of shells from Eastern United States.

D. N. McCadden. *Polygyra albolabris* Say from Wynnewood, Pennsylvania.

Dr. H. B. Meredith. Two trays of shells from New Jersey and Pennsylvania.

Rev. H. E. Meyer. Five species of exotic shells.

J. B. Mockridge. Five species of Canadian land shells.

Clarence B. Moore. Six trays of shells from Florida.

Miss. Emmeline Moore. Eight trays of fresh water shells from New York.

Winthrop M. Munro. Two species of land shells from Texas.

Mrs. I. S. Oldroyd. Two marine shells from California.

C. R. Orcutt. Six Californian marine shells.

Lt. Col. A. J. Peile. Nineteen trays of land shells from India and England.

Dr. H. A. Pilsbry. Five hundred and thirty-four trays of shells from the Hawaiian Islands and New York.

Purchased. One hundred and eighty trays of shells.

Joseph Rosenfelt. One pearl from *Ostrea elongata* Sol.

A. E. Salisbury. *Succinea putris* L. from near Iver, England.

Miss F. A. Shortridge. *Murex saxatilis* Lam. from China.

C. T. Simpson. Thirteen trays of *Liguus* from Florida.

W. J. Sinclair. *Succinea grosvenori* Lea from the Loess at Cedar Pass, South Dakota.

H. E. Snyder. Two Japanese marine shells.

Irwin Spalding. *Gastrocopta servilis* Gld. from Honolulu, Oahu Id., Territory of Hawaii.

Dr. Witmer Stone. Forty-two trays of shells from Kentucky and New Jersey.

Miss Marion J. Tayntor. Two marine shells.

D. Thaanum. Thirteen trays of shells from Japan and the Territory of Hawaii.

L. A. Thurston. Three species of land shells from Florida.

J. R. L. Tomlin. Twenty trays of Pupillidae from the Madeira Islands.

L. Van Hyning. *Marginella succinea* Conr. from Boca Ceiga Bay, Florida.

Dr. Bryant Walker. Seven South American land shells.

Miss H. N. Wardle. Twelve species of shells from Ocean City, New Jersey.

H. Warford. Three species of land shells from Pennsylvania.

Miss Helen Winchester. *Polygyra tridentata* Say from Revis Falls, Pennsylvania.

H. P. Woodward. Seven fresh water shells from New York.

D. H. Wright. *Littorina littorea* L. from Newport, Rhode Island

INSECTS

ACADEMY-AMERICAN MUSEUM EXPEDITION, 1916. Twenty-eight Orthoptera, Southern Arizona.

C. P. ALEXANDER. Forty-eight Tipulidae, South America.

A. R. ALLEN. Male of *Pelecinus polyturator*, Maine.

F. E. BLAISDELL. *Eleodes fuchsi* (paratype), California.

ALFREDO BORELLI. Twenty-eight Dermoptera (twelve paratypes), Costa Rica (in exchange).

ANNETTE F. BRAUN. Fourteen Microlepidoptera, United States; thirty from Glacier National Park.

BRITISH MUSEUM. Two Butterflies, West Indies.

E. R. BUCKELL. One hundred and ten Orthoptera, British Columbia.

F. R. COLE. Three Diptera, California.

W. J. COXEY. Two *Pyrameis gonerella*, New Zealand; *Papilio weiskei*, New Guinea; *Antheraea suraka*, Madagascar; six Lepidoptera, Australia.

W. C. DUKES. Three *Aegeria tepperi*, Mobile, Alabama.

HENRY FOX. Four Orthoptera, New Jersey and Georgia.

HUGH GIBBON. Seventy-five Butterflies, Manitoba.

FRANK HAIMBACH. Four Moths, Massachusetts.

MORGAN HEBARD. Nine exotic Butterflies; four Odonata, Florida; two hundred and thirty-four Lepidoptera; twenty-seven *Conalcaea coyoterae*, Prescott, Arizona; one hundred and thirty-seven Insects; one Hemipteron, Liberia.

HEBARD-ACADEMY EXPEDITION 1921. Four thousand Orthoptera, western United States.

WHARTON HUBER. Eighty-two Lepidoptera, Borneo, and fifteen from United States; thirteen Coleoptera, Penna.

F. J. KEELEY. One *Phengodes*, Florida.

E. A. KLAGES. Two Coleoptera, Venezuela.

PHILIP LAURENT. Twenty-nine Diptera and Orthoptera, Florida; four Moths, Pennsylvania.

R. A. LEUSSLER. Two *Pamphila ogallala* (paratypes), Nebraska; thirty-three Lepidoptera, Nebraska.

FRANK R. MASON. Three Lepidoptera, Mount Washington, New Hampshire.

LEVI W. MENGEL. Four hundred Oriental Moths.

MUSEU PAULISTA. Thirteen Orthoptera, South East Brazil.

H. M. PARSHLEY. Thirty-two *Aradus*, United States.

A. F. PORTER. Fifty-five Butterflies, Miami, Florida.

PURCHASED. Twenty-four Neotropical Gesperidae; one hundred and seventy-three Orthoptera, South America.

C. T. RAMSDEN. *Xylophanes clarki* (type). Guantanamo, Cuba.

J. C. SELTZER. Trap-door Spider, California.

HENRY SKINNER. Seventy-six Lepidoptera, Arkansas.

STOCKOLM MUSEUM. Thirty-two European Orthoptera (in exchange).

WITMER STONE. Nine Moths, New Jersey.

TRANSVAAL MUSEUM. One hundred and four Blattidae, Transvaal, Natal, thirty-nine species, eighteen paratypes.

UNITED STATES NATIONAL MUSEUM. Thirty-three specimens of Cynipidae (paratypes and cotypes); thirteen Galls.

UNIVERSITY OF MICHIGAN. One hundred and eleven Orthoptera, North Dakota and Michigan.

OTHER INVERTEBRATES

I. S. FISHBLATT. *Geocarcinus ruricola* (L.) from Off Atlantic City, New Jersey.

J. G. MALONE. Seven trays of Invertebrates from Oregon.

D. N. MCCADDEN. *Portunnus sayi* (Gib.) from Ocean City, New Jersey.

C. R. ORCUTT. Two *Balanus* from Lower California.

DR. H. A. PILSBRY. Twelve trays of Invertebrates from the Hawaiian Islands.

CAPT. F. A. POTTS. Two Barnacles from Samoa Islands.

U. S. NATIONAL MUSEUM. Seven Barnacles from California and the Atlantic Ocean.

FOSSIL INVERTEBRATES

LOUIS H. BREGY. Land Shells in a stone from Zion Canyon, Utah.

T. D. A. COCKERELL. Fossil Coral from the Madeira Islands.

MORGAN HEBARD. Fifty-nine species of Shells from Florida and Australia.

CARL B. METZGER. *Lepidodendron* from Pennsylvania.

DR. H. A. PILSBRY. Seven trays of Pleistocene Shells from Oahu Island, Territory of Hawaii.

EMMA WALTER ESTATE. Type of *Murex shilohensis* Heilprin from Cumberland Co., New Jersey.

MINERALS

SAMUEL G. GORDON. Fifteen Pennsylvania Minerals.

FREDERICK HILBIBER and JOHN TALLIS. Collection of Minerals from Perkiomenville, Montgomery County, Penna.

HARRY W. TRUDELL. Samarskite, Mineral Hill, Delaware County, Penna.

ROCKS

SAMUEL G. GORDON. Six Pennsylvania Rocks; Collection of Rocks from the Andes.

PLANTS

CORNETT ARMSTRONG. *Magnolia acuminata*, cultivated.

FRANK BALL. *Panicum flexile* and *Cynosurus cristatus* from Bucks County, Pennsylvania.

G. W. BASSETT. Several collections from New Jersey and Pennsylvania. See also Mrs. J. C. Dorphley, below.

W. M. BENNER. Numerous specimens from Bucks County, Pennsylvania.

CLEMENT BIDDLE. Fungus, *Peridermium cerebrum*, from Virginia.

O. H. BROWN. Twenty-five specimens from Cape May County, New Jersey.

JOHN CAWLEY. *Microstylis ophioglossoides* from Bucks County, Pennsylvania

I. W. CLOKEY. Thirty-two Scrophulariaceae from Colorado.

MRS. J. C. DORPHLEY & G. W. BASSETT. Herbarium of Frank Bassett, containing many specimens, chiefly from New Jersey.

J. W. ECKFELDT. Two specimens from New Jersey and Pennsylvania.

W. C. FERGUSON. *Lycopodium carolinianum* from Long Island.

J. M. FOGG, JR. A few specimens from Philadelphia.

H. W. FOWLER. Two specimens of water-plants from Georgia and Alabama.

C. D. FRETZ. Seventy-five flowering plants from Bucks County, Pennsylvania.

C. D. LIPPINCOTT. *Alopecurus myosuroides* from Swedesboro, New Jersey.

BAYARD LONG. Numerous plants from New Jersey and Pennsylvania.

DR. H. B. MEREDITH. Many local plants, and also collections from northeastern Pennsylvania.

J. C. NELSON. Nearly 1000 specimens, from western Oregon.

NEW YORK BOTANICAL GARDEN. 1400 specimens in exchange.

REV. J. P. OTIS. Fifty plants from Delaware chiefly.

DR. F. W. PENNELL. Two-hundred plants from Nantucket, Massachusetts. Also thirty Scrophulariaceae from various collectors.

H. W. PRETZ. Six hundred specimens, chiefly from Lehigh County, Pennsylvania.

MISS MARGARET SHEPPARD. Seven pine cones collected by J. S. Lippincott and H. N. Bolander, chiefly in California.

DR. WITMER STONE. Many local plants, especially from Cape May County, New Jersey.

F. H. STROHM. Several local plants, chiefly from Bucks County, Pennsylvania.

DR. WILLIAM TRELEASE. Fragment of fungus, *Labrella pomi*, from type in Museum d'Histoire Naturelle, Paris, France.

S. S. VAN PELT. *Euphorbia esula* from Philadelphia.

ARCHEOLOGY

MISS GERTRUDE ABBOTT. Woman's skirt of bark-cloth. Borneo.

DR. W. L. ABBOTT. Stone celt: modern wallet of palm-leaf. Santo Domingo.

R. DALE BENSON JR. Indian blanket of snow-shoe rabbit skins. White Fish, Province of Quebec.

DR. I. MINIS HAYES. Grooved axe-head.

MORGAN HEBARD. Archeological material from an Indian village site. Wisconsin.

J. G. MALONE. Cowry clusters, said to be used as money.

ROYAL ONTARIO MUSEUM OF ARCHAEOLOGY, TORONTO, in exchange. Ancient Tarascan pottery. Mexico.

UNIVERSITY OF ARIZONA MUSEUM, in exchange, Cliff-dwellers' remains: implements, pottery, clothing, etc.

UNIVERSITY OF COLORADO MUSEUM, in exchange. Stone implements from ancient Pueblos, etc.

Reports of Sections.

Report of the Biological and Microscopical Section for the year 1921.—The Biological and Microscopical Section held nine meetings during the year. The membership has slightly increased and the average attendance has been larger than for several years past.

In conjunction with the Mineralogical and Geological Section, twenty-two weekly excursions were made to various localities in Pennsylvania and New Jersey, with an average attendance on each trip of fourteen members and their friends.

Communications were made by the following members: Messrs. Bilgram, T. C. Palmer, Stewart, Van Siekel, Poyser, Munro, Keeley, W. Palmer, Gayhart, and Boyer.

The following were elected officers for the year 1922:

Director	T. Chalkley Palmer
Vice-Director	John A. Shulze
Recorder	Charles S. Boyer
Corresponding Secretary	Walter Palmer
Treasurer	Thomas S. Stewart
Conservator	F. J. Keeley

Charles S. Boyer,
Recorder.

Entomological Section.—All the stated meetings of the Section have been held, with an average attendance of twelve persons. Interesting communications and exhibits have been made by the members, contributors, and occasional visitors. Messrs. John C. Hollinger, Max Kisliuk, Jr., Richard C. Norris, Jr., and R. C. Hutchison, were elected Contributors.

The officers and committee elected to serve for 1922 are:

Director	Philip Laurent
Vice-Director	R. C. Williams, Jr.
Recorder	E. T. Cresson, Jr.
Secretary	J. A. G. Rehn

Treasurer	E. T. Cresson
Conservator	Henry Skinner

Publication Committee: E. T. Cresson, P. P. Calvert, E. T. Cresson, Jr.

E. T. CRESSON, JR.,
Recorder.

MINERALOGICAL AND GEOLOGICAL SECTION.—As was the case during previous years, the chief activities of the Mineralogical and Geological Section have been confined to the weekly excursions, jointly with the Microscopical and Biological Section, during the Spring and Fall months, when many interesting localities were visited.

At a recent meeting, Mr. Samuel G. Gordon described his expedition to South America and exhibited a number of the more interesting minerals collected.

The following were elected officers to serve during the ensuing year:

Director	F. J. Keeley
Vice-Director	T. Chalkley Palmer
Conservator	George Vaux, Jr.
Treasurer	Thomas S. Stewart
Recorder and Secretary	Samuel G. Gordon.

F. J. KEELEY,
Director.

ORNITHOLOGICAL SECTION.—The Ornithological Section has exerted itself during the year to increase interest in the department of birds. The Delaware Valley Ornithological Club has continued to hold its meetings in the building, and the American Ornithologists' Union convened here in November in its 39th annual meeting, bringing ornithologists from all parts of the United States and Canada to the Academy.

Officers elected to serve for the ensuing year are:

Officers	Spencer Trotter,
Vice-Director	George Spencer Morris
Recorder	Julian K. Potter
Secretary	William A. Shryock
Treasurer and Conservator	Witmer Stone.

Public Lectures.

The free public lectures given at the Academy under the auspices of the Ludwick Institute, were continued in the 1921 season. Sixteen evening lectures were given with a very gratifying attendance at each. The Lecture Committee was fortunate in obtaining prominent naturalists from other institutions who presented impressions of their field work and studies in various parts of the world. Among these were, Mr. Herbert Lang, Assistant Curator, Dept. of Mammalogy, American Museum of Natural History, N. Y., who spoke on "Big Game and Peoples of the Belgian Congo." Dr. Robert C. Murphy, Museums of the Brooklyn Institute of Arts and Science, who told about "The Penguins of South Georgia Island." "Six Years of an Ornithologist in the Belgian Congo," given by James P. Chapin, of the Dept. of Ornithology, American Museum of Natural History, and the last lecture of the Evening Course was given by Dr. J. Chester Bradley, Professor of Entomology, Cornell University, "An Entomologist's Journey through Junin and Loreto Provinces of Peru." Lectures by the resident staff were interspersed among the out of town speakers. A series of twelve Friday afternoon lectures were given by members of the resident staff, for school children. These were primarily of the local fauna and flora and more or less elementary in character. Information was sent to the principals of the public and private schools in and near Philadelphia, by means of letter and the local newspapers. Many of the schools availed themselves of these lectures which would seem to warrant their repetition next year.

Three lectures were given on consecutive Sunday afternoons, as an experiment, in February: February 6th, Dr. Witmer Stone, "A Naturalist in Arizona"; February 13th, Dr. Henry A. Pilsbry, "The Hawaiian Islands and the Volcano of Kilauea"; and February 20th, James A. G. Rehn, "Deserts and Mountains of California and Nevada." These lectures were very well attended and seemed to reach a new class of people, who had not been in touch with the work of the Academy before. Many regrets were expressed that this Sunday course was only for three Sundays. The attendance was so gratifying that the Academy and the Ludwick Institute would seem justified in continuing and extending these Sunday talks next year.

Library.

ADMINISTRATION OF THE LIBRARY.

LIBRARY COMMITTEE.

WITMER STONE, *Chairman*,
F. J. KEELEY
HENRY TUCKER
T. CHALKLEY PALMER
SPENCER TROTTER.

SPENCER TROTTER, *Librarian.*
WILLIAM J. FOX, *Assistant Librarian.*

REPORT OF THE LIBRARIAN.

During 1921 the additions to the library total 7545, showing an increase of 621 over the preceding year. The pamphlets and parts of periodicals added are 5908, 762 are volumes, 296 maps, and 581 autograph letters from various contemporary naturalists to the late S. S. Haldeman, were presented by his grandson, Mr. Guy K. Haldeman.

The various sources of accession are as follows:

Exchange	3085
Isaiah V. Williamson Fund	2345
United States Department of Agriculture	733
Mr. Guy K. Haldeman	576
John Aitken Meigs Fund	326
Authors	47
Kentucky Department of Geology and Forestry	45
Museum of the American Indian, Heye Foundation	30
Imperial Department of Agriculture, British West Indies	24
New York State College of Agriculture	24
Editors	24
Thomas B. Wilson Fund	23
American Entomological Society	22
Pennsylvania State Library	16
New York Agricultural Experiment Station	14
Ministère des Colonies, Royaume de Belgique	13
Texas Agricultural Experiment Station	12

United States Department of Commerce	12
Utah Agricultural Experiment Station	11
Department of Agriculture, State of California	8
New York Aquarium	8
Cornell University Agricultural Experiment Station	7
Cuerpo de Ingenieros de Minas del Peru	7
Estate of Edward J. Nolan	6
Publication Committee of the Academy	6
Department of Conservation and Development, New Jersey	5
Mississippi State Geological Survey	5
Dr. William L. Abbott	4
Department of Marine and Fisheries, Canada	4
Argentine Government	4
Geological Survey of Victoria	4
Biological Board of Canada	4
California State Fish and Game Commission	3
Imperial Entomologist, Pusa India	3
Dr. Henry Skinner	3
United States War Department	3
Observatorio Meteorologico de la Escuela Normal de Varones	2
Lowell Observatory	2
State Geologist of South Dakota	2
Survey of India	2
Statens Skogsförsöksanstalt	2
National Research Council	2
New York State Archeological Association, Morgan Chapter	2
Geological Survey of Georgia	2
University of Washington	2
Government of the Phillippine Islands	2
Carleton College	2
San Diego Society of Natural History	2
South Dakota School of Mines	2
University of Idaho	2
Mr. Philip Ainsworth Means	2
Michigan College of Mines	2
Pennsylvania Topographic and Geological Survey	2
Dr. W. W. Keen	2
New York State Library	2
Library of Congress	1
Japan Society	1
New South Wales, State Fisheries	1
Boston City Hospital	1
Charles Lathrop Pack	1
Wagner Free Institute of Science	1
Department of Naval Service, Canada	1
National Forest Reservation Commission	1
Société Hollandaise des Sciences à Harlem	1

Observatorio de Madrid	1
Colorado Museum of Natural History	1
North Carolina Geological and Economic Survey	1
Rockefeller Institute for Medical Research	1
French Government	1
Health Department of the Panama Canal	1
Rhinebeck Bird Club	1
William J. Fox	1
Southwest Museum	1
University of Tennesee	1
Albert Ier, Prince de Monaco	1
Tokyo Imperial Museum	1
Conseil International de Recherches	1
Michigan Geological and Biological Survey	1
Scientific Society of San Antonio	1
Dr. Philip P. Calvert	1
Hercules Powder Company	1
Board of Water Supply of New York City	1
Messrs. Vechting Waring Company, New York City	1
Government of Formosa	1
Entomological Society of Nova Scotia	1
Geological Survey of Alabama	1
Raffles Museum and Library	1
Zoological Society of Philadelphia	1
Board of Scientific Advice for India	1
Provincial Museum of Natural History	1
Surgeon General, U. S. A.	1
Government of India	1
South Dakota Geological Survey	1
P. Blakiston's Son and Co., Philadelphia	1
Philadelphia Museums	1
Queensland Department of Mines	1
Commissioners on Fisheries and Game, Massachusetts	1
Haverford College	1

These have been distributed to the various departments as follows:

Journals	5038
Agriculture	750
Geology	385
Botany	310
Geography	123
General Natural History	85
Entomology	64
Voyages and Travels	57
Mineralogy	28
Anatomy and Physiology	20

Ornithology	20
Anthropology	19
Ichthyology	13
Conchology	12
Helminthology	12
Herpetology	10
Physical Sciences	8
Bibliography	6
Mammalogy	2
Chemistry	1
Medicine	1
Autograph Letters	581

These journals and transactions, new to the library, were added, either by purchase or exchange:

Acta Academia Aboensis. Abo.
Acta Forestalia Fennica. Helsingfors.
Acta Zoologica. Stockholm.
American Museum Novitates. New York.
Archiv für Molluskenkunde. Frankfurt a. M.
Archives Néerlandaises de Physiologie de l'Homme et des Animaux, La Haye.
Bataafsch Genootschap der Proefondervindelijke Wijsbegeerte, Rotterdam. Verslag der Voordrachten van Leden.
Congreso Nacional de la Industria Minera, Lima. Anales.
Conseil International de Recherches (Section d'Océanographie Physique). Bulletin.
Department of Agriculture, Trinidad and Tobago. Memoirs.
Department of Conservation State of Indiana. Publications.
Department of Geology and Forestry of Kentucky. Publications.
Faculte des Sciences de l'Université Masaryk. Brno. Publications.
Genetica. 's-Gravenhage.
Guam Agricultural Experiment Station. Circular.
Hawaiian Volcanic Observatory. Weekly (Monthly) Bulletin.
Hereditas Genetisk Arkiv. Lund.
Illinois State Academy of Sciences, Urbana. Transactions.
Journal of Comparative Psychology, Baltimore.
Kryptogamische Forschungen (Bayerische Botanische Gesellschaft). München.
Micrographe (Le) Preparateur, Paris.
Prometheus, Berlin.
Psychobiology, Baltimore.
Revue d'Ethnographie et des Traditions Populaires, Paris.
Rhinebeck Bird Club. Yearbook.
Rockefeller Institute for Medical Research, New York. Monographs.
School of Forestry University of Idaho. Bulletin.
Senckenbergiana. Frankfurt A. M.
Sociedad Iberica de Ciencias Naturales, Zaragoza. Memorias.
Société d'Études des Sciences Naturelles de Nimes. Bulletin

Société Géologique et Minéralogique de Bretagne, Rennes. Bulletin.
Stazione Zoologica di Napoli. Pubblicazioni.
University of California Record.
Stanford University Publications (Series in Mathematics and Astronomy, Biological, and Languages).
Zeitschrift für die gesammte Anatomie (I. Abteilung,—Zeitschrift für Anatomie und Entwicklungsgeschichte), München.
Zeitschrift für technische Biologie (*continuation* of Zeitschrift für Gärungsphysiologie, u. s. w.), Berlin.

Among the important additions to the library is a collection of twenty-six volumes of the works of Linnaeus, representing chiefly editions not hitherto in the possession of the Academy. A fine copy of J. C. D. Schreber, Beschreibung der Gräser, Folio, Leipzig, 1769–1810, was acquired by purchase.

Eight hundred and fourteen volumes have been bound; and 170 pamphlets and 33 volumes on subjects not pertinent to the Academy's objects, were transferred to the Free Library of Philadelphia.

Fourteen hundred and thirty volumes and parts of periodicals were used on the premises by the scientific staff; and 185 volumes were borrowed by members

A framed portrait, in oil by Hewitt, of the late Dr. Edward J. Nolan, Librarian of the Academy, 1867–1921, and portraits of the late Dr. Joseph Leidy, and J. Dickinson Sergeant, who was Librarian from 1862 to 1866, were received from the Estate of Edward J. Nolan.

WILLIAM J. FOX,
Acting Librarian.

Secretaries.

REPORT OF THE RECORDING SECRETARY.

The outstanding duty of the Recording Secretary in the present report is the sad one of bringing to the attention of the members of the Academy the passing of one who for many years contributed this report, and for over half a century was so closely and intimately associated with the institution and its activities,—Dr. Edward J. Nolan. In deference to the wish specifically expressed in his last testament, an injunction from a departed and beloved friend and colleague, no biographical sketch of Dr. Nolan's life has been published by the Academy. At the Academy meeting of January 18, 1921, shortly after his death, an appreciation of Dr. Nolan and his work was read by the President, Mr. Cadwalader. This well-earned tribute to the steadfast devotion of the departed, will, in consequence of his prohibition, be recorded solely upon the minutes of the Academy.

Elected Recording Secretary of the Academy December 29, 1874, Dr. Nolan served continuously in that post until, on account of failing health, he was relieved of the responsibilities of the office. At the meeting of the Academy held November 16, 1921, he was elected Recording Secretary Emeritus, and the present incumbent was nominated to handle the active work of the office. Unfortunately, for but a few weeks was our friend permitted to enjoy the honored calm of work well-done, as, on January 7, 1921, he passed away.

Meetings of the Academy have been held December 21, 1920; January 18, February 15, March 15, April 19 and November 15, 1921. The average attendance at the meetings was twenty-six members and forty-three visitors. Communications were made by Dr. William E. Hughes, Arthur H. Fisher, Dr. Henry Skinner, J. Fletcher Street, and James A. G. Rehn.

During the past year thirteen members have died and five have resigned. The following individuals were elected members:

T. Ellis Barnes, R. Dale Benson, Jr., Mrs. Andrew Alexander Blair, Dr. Joseph Hall Bodine, Mrs. Edward Bok, Lambert Cadwalader, Dr. John B. Carson, John D. Carter, Wilson Catherwood, Charles D. Clark, Dr. C. Montague Cooke, Alexander Brown Coxe, Mrs. James H. R. Cromwell, George K. Crozer, Jr., Edwin S. Dixon, Jr., Archibald M. L. duPont, E. Paul duPont, Thomas Langdon Elwyn, William Newbold Ely, Samuel S. Fels, Mrs. Stanley G. Flagg, Jr., C. F. Fox, Stephen Fuguet, Mrs. Eva B. Gadsby, Thomas S. Gates, John Gilbert, Henry Frazer Harris, George L. Harrison, Mrs. Charles W. Henry, John C. Holinger, Wharton Huber, Charles F. Jenkins, Dr. Victor A. Loeb, C. Christopher Morris, Frederick Wistar Morris, Jr., Dr. Samuel Copeland Palmer, Dr. Francis W. Pennell, Thomas Robins, John W. Schell, Dr. William Randolph Taylor, John Wagner, Miss Hepsey Norris Wells, Dr. D. H. Wenrich, Dr. Arthur DeWitt Whedon, and Walter Wheeler.

By action of the Council the direction of a membership campaign was placed in charge of the Recording Secretary. The first stage of this campaign has been carried out, with very gratifying success, and a continuation of the work in new directions and along special lines is planned for 1922.

Changes in the By-Laws of the Academy were adopted by the Academy February 15, 1921, which provide for six classes of members: Benefactors, Sustaining Members, Life Members, Annual Members, Associate Members, and Junior Members. Briefly summarized the requirements of these classes are: Benefactors make a contribution of $10,000; Sustaining Members, one of $1,000; Life Members, one of $100; Annual Members, an annual contribution of $10; Associate Members are required to reside at least fifty miles from Philadelphia City Hall, and to make an annual contribution of $5; Junior Members are required to be less than twenty-one years old when elected, and to make an annual contribution of $3. Neither Associate nor Junior Members can vote or hold office, and at the age of twenty-five Junior Members pass automatically to the class of Annual Members.

Additional amendments to the By-Laws, adopted the same date as those relative to membership classes, removed from the Recording Secretary the necessity of being Editor of the publications of the Academy, and placed in the hands of the Publication Committee, subject to the approval of the Council, the selection of the Editor.

The Recording Secretary desires to express to the officers and councilors of the Academy, his appreciation of the consideration shown and assistance given his efforts to discharge satisfactorily the duties so ably handled by the experienced hands of his predecessor in office.

JAMES A. G. REHN,
Recording Secretary.

REPORT OF THE CORRESPONDING SECRETARY.

The deaths of correspondents reported during the year were as follows: Joel A. Allen, Wm. A. Buckhout, and Charles B. Cory. No correspondents were elected.

As indicating the renewal of the international exchange of amenities between scientific and educational institutions an increased number of invitations was received. Among the more important of these events were the fifty-year jubilee of the Geological Society of Stockholm; the twenty-fifth annual meeting of the American Academy of Political and Social Science, to which the President appointed Dr. Macfarlane, Dr. Stone, and the corresponding secretary as delegates; the centenary celebration of the founding of the Philadelphia College of Pharmacy and Science to which Mr. Rehn was made a delegate; the Second International Congress of Eugenics at which the Academy was represented by Professors Conklin and McClung; the inauguration of Dr. J. M. Thomas as President of Pennsylvania State College; the semicentenary of the Society for the Study of the Fauna and Flora of Finland; the seven-hundreth anniversary of the founding of the University of Padova; the postponed International Geological Congress to be held in Brussels; and the organization under the auspices of the National Research Council of an Institute for Research in Tropical America to which Dr. Stone was delegated to represent the Academy. To those gatherings at which representation of the Academy was impractical letters of felicitation or addresses were sent.

From the American Ornithologists' Union was received a resolution thanking the Academy for courtesies extended during its thirty-fifth stated meeting.

A copy of a bronze medalion commemorative of its semi-centennial celebration was received from the Wisconsin Academy of Sciences, Arts and Letters.

Other correspondence was conducted as usual.

Communications received:

Acknowledging the receipt of the Academy's publications	147
Transmitting publications to the Academy	43
Requesting exchanges or the supply of deficiencies	15
Photographs of correspondents	2
Invitations to learned gatherings, celebrations, etc.	12
Notices of deaths of scientific men	6
Circulars concerning the administration of scientific and educational institutions, etc.	17
Letters from correspondents and miscellaneous letters	84
Total received	326

Communications forwarded:

Acknowledging gifts to the Library	822
Requesting the supply of deficiencies	170
Acknowledging gifts to the Museum	
Acknowledging photographs and biographies of correspondents	2
Letters of sympathy or congratulation, addresses, etc.	8
Diplomas and notices of election of correspondents, and delegates' credentials	7
Miscellaneous letters	103
Annual reports and circulars sent to correspondents	190
Total forwarded	1302

J. PERCY MOORE,
Corresponding Secretary.

Publications.

PUBLICATION COMMITTEE.

HENRY SKINNER, *Chairman*, WITMER STONE,
HENRY A. PILSBRY, WILLIAM J. FOX, MILTON J. GREENMAN.
EDITOR: WILLIAM J. FOX.
Artist: HELEN WINCHESTER.

With the appearance of the number now on the press, 1921, Part II, the Academy will have published 559 pages and 49 plates of its PROCEEDINGS for 1921. The Annual Reports for 1920, forming 57 pages and 6 plates, were issued in separate form, and not with the PROCEEDINGS, as in the past.

The Entomological Section of the Academy published 330 pages and 5 plates of the ENTOMOLOGICAL NEWS; and the American Entomological Society with the cooperation of the Academy 268 pp. and 15 plates of its TRANSACTIONS.

Dr. Pilsbry, editor of the MANUAL OF CONCHOLOGY, has issued during the year parts 101, 102, and 103, of that publication, or 192 pages and 18 plates.

With the exception of Russia, exchange of publications has been resumed with institutions in countries closed during the world war.

WILLIAM J. FOX
Secretary of the Committee.

Treasurer.

SUMMARY OF THE ACCOUNTS OF GEORGE VAUX, JR., TREASURER OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, FOR THE FISCAL YEAR ENDED NOVEMBER 30, 1921

GENERAL FUND

RECEIPTS.

Balance on hand 30th November, 1920		1,869.93
Income from investments		44,233.99
Income from Estate of John Turner, dec'd		152.35
Annual dues		2,235.00
Interest on Bank Balances		420.09
Publications sold		505.79
Income Account of 1309 Arch Street		198.35
Transfer from Funds:—		
Jeanes Fund for Museum Expenses	800	
Wilson Fund for Librarian's salary	400	
		1,200.00
		$50,815.50

PAYMENTS.

Refunded to Wm. S. Vaux Fund, for part of cost of goniometer	250.00
General expenses, including fuel, light, water, building repairs, etc.	6,774.36
Petty expenses	300.00
Binding	1,491.95
Recording Secretary, salary and expenses	722.46
Printing Proceedings	2,705.48
Specimens and Expeditions	337.01
Expenses of Treasurer's Department	535.68
Salaries in Curators' Department	27,143.64
Salaries in Librarian's Department	2,458.34
Museum Cases	836.00
Librarian's expenses	113.27
Corresponding Secretary's expenses	40.00
Mary S. Warren, on account of 1309 Arch Street	1,800.00
Estate of Robert H. Lamborn, dec'd., for taxes, etc., on lands in Colo.	3,250.00
Balance on hand 30th November, 1921	2,057.31
	$50,815.50

Conchological Section Fund

Receipts.

Net Income collected	492.59
Balance overdrawn 30th November, 1921	912.37
	$1,404.96

Payments

Balance overdrawn 30th November, 1920	1,304.96
Cash to S. Raymond Roberts	100.00
	$1,404.96

Cope Collection Fund

Receipts.

Balance on hand 30th November, 1920	2,365.10
Net Income collected	782.88
Balance on hand 30th November, 1921	$3,147.98

F. V. Hayden Memorial Fund

Receipts.

Net Income collected	102.22

Payments.

Balance overdrawn 30th November, 1920	50.99
Balance on hand 30th November, 1921	51.23
	$102.22

Horace N. Potts Fund

Receipts.

Balance on hand 30th November, 1920	57.16
Net Income collected	481.16
Balance on hand 30th November, 1921.	$475.32

Mary Jeanes Museum Fund

Receipts

Balance on hand 30th November, 1920	13.09
Net Income collected	870.00
	$883.79

PAYMENTS.

Tranferred to General Fund for Museum expenses	800.00
Balance on hand 30th November, 1921	83.79
	$883.79

JESSUP FUND, MALE BRANCH

RECEIPTS.

Balance on hand 30th November, 1920	684.53
Net Income collected	630.02
	$1,314.55

PAYMENTS.

Salaries to students	810.00
Balance on hand 30th November, 1921	504.55
	$1,314.55

JESSUP FUND, FEMALE BRANCH

RECEIPTS.

Balance on hand 30th November, 1920	93.03
Net Income collected	222.86
	$315.89

PAYMENTS.

Salaries to students	223.40
Balance on hand 30th November, 1920	92.49
	$315.89

J. A. MEIGS LIBRARY FUND

RECEIPTS.

Balance on hand 30th November, 1920	162.86
Net Income collected	555.47
Balance overdrawn 30th November, 1921	1,067.24
	$1,785.57

PAYMENTS.

Books purchased	1,785.57
	$1,785.57

J. H. REDFIELD MEMORIAL FUND

RECEIPTS.

Balance on hand 30th November, 1920	171.92
Net Income collected	192.71
Accumulated Income in hands of late Treasurer of Botanical Fund transferred back into this account	388.13
	$752.76

PAYMENTS.

Transferred to Botanical Section	296.40
Balance on hand 30th November, 1921	456.36
	$752.76

MARY REBECCA DARBY SMITH FUND

RECEIPTS.

Balance on hand 30th November, 1920	113.01
Net Income collected	71.52
	$184.53

PAYMENTS.

Balance on hand 30th November, 1921	184.53
	$184.53

AUBREY H. SMITH FUND

RECEIPTS.

Balance on hand 30th November, 1920	1,745.65
Net Income collected	735.51
	$2,481.16

PAYMENTS.

Balance on hand 30th November, 1921	2,481.16
	$2,481.16

FRANCES LEA CHAMBERLAIN FUND

RECEIPTS.

Balance on hand 30th November, 1920	480.38
Net Income collected	110.83
	$591.21

PAYMENTS.

Balance on hand 30th November, 1921	591.21
	$591.21

THOMAS B. WILSON FUND

RECEIPTS.

Balance on hand 30th November, 1920	235.15
Net Income collected	488.35
	$723.50

PAYMENTS.

Books purchased	225.52
Transferred to General Fund for Librarian's salary	400.00
Balance on hand 30th November, 1921	97.98
	$723.50

WILLIAM S. VAUX FUND

RECEIPTS.

Balance on hand 30th November, 1920	1,561.43
Net Income collected	479.75
Transferred from General Fund towards cost of goniometer	250.00
	$2,291.18

PAYMENTS.

Minerals purchased	1,153.10
Cost of goniometer	303.00
Balance on hand 30th November, 1921	835.08
	$2,291.18

I. V. WILLIAMSON FUND

RECEIPTS.

Balance on hand 30th November, 1920	38.51
Net Income collected	1,457.81
Balance overdrawn 30th November, 1921	115.30
	$1,611.62

PAYMENTS.

Books purchased	1,611.62
	$1,611.62

SPECIAL DONATIONS

RECEIPTS.

Balance on hand 30th November, 1920	689.38
Donations received	600.00
	$1,289.38

PAYMENTS.

Expenditures for cases, membership campaign, etc.	768.05
Balance on hand 30th November, 1921	521.33
	$1,289.38

J. F. BEECHER MEMORIAL LABORATORY FUND

RECEIPTS.

Balance on hand 30th November, 1920	2,229.83
Net Income collected	940.83
Balance on 30th November, 1921	$3,170.66

GENERAL ENDOWMENT FUND.

RECEIPTS.

Balance on hand 30th November, 1920	373.79
Net Income collected	179.67
Balance on 30th November, 1921	$553.46

Respectfully submitted,

GEORGE VAUX, JR.,
Treasurer.

E. and O.E.
Philadelphia.
November 30, 1921.

We herewith report that we have made an audit of the books and accounts of George Vaux Jr., Esq., Treasurer of the Academy of Natural Sciences of Philadelphia, for the fiscal year ended November 30th, 1921.

As the result of our audit we certify the above statements are in accord with the records of the Girard Trust Company, Agent, and with the Treasurer's books, respectively, and are in our opinion correct.

All of the income received during the year was accounted for and entered upon the books. The payments, as shown by the Cash Book, were properly supported by statements, checks, or vouchers, and were found to be correct. A reconciliation of the deposit account with the Girard Trust Co., was made by us and the correctness of the Cash Balance as shown by the Treasurer's books verified thereby.

All of the securities owned as shown by Schedule "A" were in the custody of the Girard Trust Company as Agent and were examined by us with the exception of two bonds and mortgages which were not produced for our inspection

December 19th, 1921. (Signed) EDWARD P. MOXEY & CO.

Certified Public Accountants.

REPORT OF THE TREASURER OF THE MANUAL OF CONCHOLOGY

The Treasurer of the "Manual of Conchology" respectfully reports that:

During the year ending November 30th, 1921, the receipts from all sources were	1,226.02
And disbursements	890.35
Leaving a balance of	335.67
Adding to this, balance December 1, 1920	183.81
Leaves balance December 1, 1921	$519.48

The receipts were as follows:

From Subscriptions, Manual Vol. XXV	27.50	
" Subscriptions, Manual Vol. XXVI	871.07	
" Sale of back volumes and parts	220.10	
" Academy of Natural Sciences	100.00	
" Interest on daily Bank Balances	7.35	
		$1,226.02

The disbursements were:

For Engraving and printing plates,	105.50	
" Colorists	58.00	
" Paper and printing	532.95	
" Binding parts	53.87	
" Postage, Expressage, etc.	34.53	
" Payment of loan from, H. A. Pilsbry	25.00	
" Refund to Geo. M. Crofts	1.00	
" Wm. Wesley and Son, Transfer from Deposit account	79.50	
		890.35

The Balance on hand is subdivided as follows:	519.48
For "Manual" Account	443.23
Wesley and Son, on deposit subject to call	76.25

The Publication Committee has continued to assume payments of salaries of Editor, Conservator, and Draughtsman, formerly charged to the "Manual", which has relieved it of a heavy burden upon its resources.

Respectfully submitted,

S. RAYMOND ROBERTS,

Treasurer.

November 30, 1921.